















# The National Encyclopedia



# THE NATIONAL ENCYCLOPEDIA

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# The National Encyclopedia

## INTRODUCTORY

**T**HE NATIONAL ENCYCLOPEDIA is a completely new work. Practically all encyclopedias now available to the public are revisions of revisions. The work here presented is not. It represents a fresh attack upon the problem of providing the average reader with an authoritative reference work, reduced to the smallest feasible compass, and devised to answer quickly the questions which everyday contemporary life provokes. The National Encyclopedia is new in plan and new in workmanship.

### **The needs it serves**

There is a wide and growing demand for a new kind of encyclopedia, one which will serve the needs of the ever-increasing number of men and women who wish to know the accurate fact, the specific meaning, and the real significance of topics and subjects now likely to be mentioned frequently in daily conversation and reading. The editors and publishers of these volumes aim to meet the needs of those men and women who have acquired or wish to acquire the strategically intelligent habit of clearing up ignorance, half knowledge, confusion, and perplexity as these arise in the classroom, the office, the workshop, the social circle, the club, or the home. Their purpose has been to provide a facility that will render this service in the smallest possible compass and at a price which will make it widely available.

The body of knowledge which is of common concern to everybody enlarges with each passing year. The men and women of this day live a life larger than that of their immediate neighborhoods and working groups. The problems and events of the whole world reach into their homes and shops, affecting their daily lives and their destinies.

The air-mail, the telegraph, the telephone, and the radio collect swiftly the facts of life from every

place and distribute them everywhere. The daily newspaper, the weekly periodical, the monthly magazine, and the multitude of books, pouring miraculously from giant presses, present them to all who can read. Thus science, technology, and finance have given mankind the swift and inclusive means of communication which make each man's affairs those of every man.

Modern transportation ties men together as powerfully as the widespread news. Ship, railroad, motor, and airplane stimulate trade and travel, and the peoples of the world are held together in a common web of affairs, within which prosperity and adversity move as succeeding pulse-beats universally felt.

### **Common knowledge enlarges**

There is now more to know of the physical, economic, social, and political world. Information multiplies. The explorer, the traveler, and the reporter discover new situations of interest. The scientist, and the scholar, ever penetrating beneath obvious and current knowledge, reveal new basic facts which deepen insight. The technical inventor, the social and political reformer, the economic organizer, continually create new agencies by which the physical world and the institutions of our social civilization are made more usable for man's work and recreation.

### **The need of men to know**

Specialist and expert touch, widen, and influence our common life as never before, and we wish to know more of their thought, not alone for the practical purposes of every day living but for the maintenance of that human dignity, self-respect, and personal confidence which are the fruitage of knowing one's way about in the world. Mind is curious, and intelligence requires authoritative

knowledge to satisfy its questionings about our ever complicating life. A genuinely useful encyclopedia should provide the answer to man's queries about things of import to him.

That humankind now recognizes its need to be intellectually alert in a modern world is manifest. The recognition is uncommonly common among the English speaking peoples of the North American continent. Among them schools enroll higher and higher percentages of the total population and hold them through longer periods of formal education than elsewhere. With each decade the school, college, and university groups increase surprisingly.

#### **More students out of school**

No less significant is the contemporaneous enthusiasm for adult or continuing self-education. Soon books will have a larger use among out-of-school folk than among school students. The archaic fallacy that education and a live interest in learning largely terminate with schooling is now receding into the limbo of disestablished truths. More and more men and women are educating themselves continuously throughout life. Thus a large majority of the population require the moment to moment assistance which a scholarly and well planned encyclopedia can provide.

In planning the National Encyclopedia this expanding group of learners has been kept in mind. The work is not arranged for the purpose of specialists, but for that of general readers, who constitute a large central bloc in the population, located between the complacently ignorant, at one end, and the highly inquisitive scientists, technologists, professionals, connoisseurs, and savants, at the other. Ever present in the attention of the makers of this work have been students enrolled in schools, from the higher elementary grades to the years of colleges, and other pursuing their studies in part-time or evening continuation schools, whether cultural or vocational in purpose. Mature persons who attend lectures and discussions, club sections and study groups or make independent use of books at home or in the public library have also been specially considered.

What the common man,—and even the specialist is a common man outside his special field of mastery—wishes to glean from brief consultation of a reference work, this encyclopedia attempts to provide in a set of volumes neither too small nor too large, but of modicum size.

#### **Main articles and supplementing items**

Necessarily such an encyclopedia requires a plan and arrangement different from those of the general encyclopedias now in current use. Long treatises or essays on large subjects have been displaced by a system of general, summarizing, or clearing articles on main topics, smaller in size than is usual and giving the essential facts of a field or subject. These are supplemented by many brief articles which cover specific items leading into the main articles. These major articles relate the items broadly, suggesting further ways of enriching the subject of interest, as well as indicating other works,—special cyclopedias and authoritative books which may be consulted in the pursuit of more expanded and intensified knowledge.

#### **Arrangement for ease of access**

It is a comparatively simple task for a scholarly departmental editor to determine what large subjects shall be treated in an encyclopedia. But the determination of the supplementing topics to be treated as brief items requires discriminating judgment and rare skill. In the attempt to include every item that may answer a query, the number may become so large as to defeat easy and economical use of the work. The too frequent pursuit of cross references from one page to another, and from one volume to another, may be wasteful as well as exasperating. Great care has therefore been exercised in selecting and distributing the short items which supplement the larger general or clearing articles on an important subject. These items have been so headed that they will lead quickly into the encyclopedia. Wherever possible the terms or phrases most frequently used in ordinary affairs have been used, and where feasible, these have been grouped together so as to avoid the turning of too many pages and the inspection of too many volumes. Wherever a single heading

could not anticipate with fair certainty the consulter's initial effort to find the knowledge required, alternate or synonymous headings, accompanied by only the briefest statement and a cross reference, have been inserted in their proper alphabetical places.

In reducing the number of headings or items to the smallest possible number that will be effective, much use has been made of all clues to the frequency with which subjects or topics recur in current readings and conversation. Statistical surveys and counts of current topics which have been made for purposes other than encyclopedia making, have served as useful guides in measuring the importance of a topic and in knowing the term which best indicates it.

#### **The standard of contemporary usefulness**

An up-to-date encyclopedia, especially when constructed within the smallest possible space limits, must have a very definite standard for excluding and including material. The standard which has been set up at the outset and maintained throughout the preparation of this work is that of highest informative usefulness in contemporary life. All the events, persons, and facts which had an importance in times past are not therefore included. But such of them as have pertinence because they are part of a tradition which continues into our present life are definitely included. Thus history suffers no neglect, but is presented in all of its significant aspects as the wider perspective of modern historical scholarship reveals them. An encyclopedia should not be made a morgue. All of biography is not treated, still less all of mythology. Name and story which are significant elements of classical literature and the source of enriching allusion in contemporary writing and current speech are of course carefully given a place. Geography receives enlarged treatment in a world that grows more neighborly. Nevertheless even geographical items are given place and space from the standpoint of the probable readers who for the most part will be English speaking persons of the United States, Canada, and Newfoundland. Because universality of knowledge once found in encyclopedias is no longer possible, a definite point of view must be

established for evaluating knowledge. The one assumed here is that of highest usefulness to the majority of our readers.

#### **Our changing interests**

Allocations of space to the major and minor departments of knowledge should reflect accurately the various vital interests of the present day. Obviously the judgments of previous encyclopedia makers provide no adequate guidance for the allotment of space to different departments. Former practices have been studied and compared, and used as a critical check. But the services which this encyclopedia aims to render largely determine its own dispositions of space. Our world has changed so rapidly that what may have been satisfactory encyclopedia practice once, is not so today. Human interests fade or intensify, and new ones enter. Thus health and medicine, science and technology, industry and business, art and recreation are growing affairs of men. They require more detailed treatment and a more ample space allotment. These requirements are reflected in the structure of the National Encyclopedia.

#### **An enduring reference work**

The term of years over which an encyclopedic reference work may have a high and lasting effectiveness or, put in different terms, a low rate of diminishing up-to-dateness, depends upon two factors.

An encyclopedia which stresses fundamental or essential facts resists obsolescence longer than one swelled with little used details. The details of a field of knowledge change more rapidly than do the basic facts.

The enduring qualities of an encyclopedia also depend to a large degree upon a favorable time of publication. Thus an encyclopedia published before or during the Great War quickly lost its authority, as do those compiled at a time in the decade when the quantitative and statistical information provided by the national censuses is already old. The publishers of these volumes chose the year 1932 as the most strategic date for a new publication. The availability of the masses of data, gathered by the more important nations during the regular census years of 1930 and 1931, confers

an advantage that no earlier publication can have and in which later publications can only share.

### **Incorporating the latest fact**

The publishers have been unusually generous in providing an editorial organization and permitting a plan of operation which guarantee that the published material shall be as recent as the date of publication. A comparatively small encyclopedia has been constructed by an unusually large staff of editors, advisors, contributors, and collaborators. Before a word was written more than a year was spent on mere planning and rechecking of plans. The whole actual process of writing, rewriting, and final editing was then completed in less than two years. Two definite responsibilities were laid upon the staff,—the original one of providing all the main articles and supplementary items, and the continuous and parallel one of reediting these so as to incorporate the latest important fact and event developed up to the moment of going to press. Only an unusually generous financial provision has made this effective procedure possible.

### **Quality of the editing**

The accurate and authoritative quality of the material included in this work is guaranteed by the names of the department and section editors, advisors, and contributors, whose status in the scientific and practical world is widely known. All are specialists who represent the best scholarship of the day. Their efforts have been coordinated through a carefully selected office editorial staff representative of the best modern experience in encyclopedia making, so that the encyclopedia emerges as a useful working whole and not as a mere collection of specific articles alphabetically arranged. The accurate knowledge of the outstanding authorities and experts who have written the articles has thus been fitted into a general plan which insures to this reference work the highly desirable qualities of conciseness, common usability, and up-to-dateness, which have been dom-

inating aims throughout the undertaking. The above are exacting standards, but they have been maintained at all stages of the enterprise.

Throughout the process of writing and editing, a separate staff of special advisers and collaborators has supplemented the labors of the authors and editors so that lucidity of presentation might be insured by clarifying illustrations and other visual aids to learning. The volumes are therefore replete with half-tones, line engravings, color plates, tables, graphs, and maps, each located where most needed. The best artistic and mechanical workmanship has been put into their preparation, not merely to ornament but to heighten the function of illustrating the text.

### **Illustrations and physical form**

Other members of the staff, reinforcing the editors and illustrators, have concerned themselves with the quality of paper and type, with the size of page and volume, and with the form of bindings. Typography and the other details of publication have been considered with the purpose of making reading easy and rapid, and consultation of the volumes a comfortable and pleasing errand.

While usability has been the primary objective at every step in the preparation, no effort has been spared in providing that aesthetic enhancement which will make the ownership and use of these volumes congenial.

The editors and publishers therefore present to the public this entirely new National Encyclopedia of general and ready information with an assurance born of the care they have taken to make the work the most serviceable yet put on the market for that large number of men and women who wish a concise, authoritative and recent work of reference. They are enthusiastic in their confidence that its basically sound plan and its discriminating execution will be appreciated by that large body of citizens whose exacting requirements it is designed to meet.

  
EDITOR-IN-CHIEF

# The National Encyclopedia

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#### Theater, Radio, and Motion Pictures

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### Sculpture

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Sculptor, known especially for his heads and torsos in marble and granite, and for his figures and bas reliefs carved in wood. His most important work is a monumental group of a mother and child, carved from a huge block of Spanish marble; his work is represented in many museums and private collections.

### ASTRONOMY

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Professor in charge of the Princeton Observatory (1920- ); Princeton Exchange Professor, Lowell Observatory, 1929; member of the International Astronomical Union; Secretary of the United States National Commission and International Astronomical Union; author of *Contributions from the Princeton University Observatory*; co-author of *Astronomy*.

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**Botany, Structural**

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**Botany, Horticultural**

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## METHOD OF CROSS REFERENCES

*Words in the articles printed in large and small capitals indicate that there is an article on that subject elsewhere in The National Encyclopedia. For example, in Volume I, page 1, in the article Aakjær, Jeppe—STEEN STEENSEN BLICHER is printed in large and small capitals, which indicates that there will be found under the last name, Blicher, a biography of that poet.*

# The National Encyclopedia

AACHEN

A

BARBITURIC

**AACHEN** or **AIX-LA-CHAPELLE**, a very ancient, beautifully situated German spa and industrial city in Rhenish Prussia near the Belgian frontier, about 45 mi. west of Cologne. The nucleus is on a hill, where the minster and rathaus take the place of the earlier Merovingian-Carolingian residence; it is surrounded by walls, beyond which lie the modern districts. Despite Aachen's great age and long history, there are few ancient buildings, as a fire in 1656 destroyed nearly all the houses. Of the early fortifications, a few gates and towers remain. One of the most notable buildings is the minster, or cathedral, the burial place of Charlemagne and Otto III. The 14th century rathaus, built on the site of the favorite residence of Charlemagne, contains the coronation hall in which 31 German kings were crowned. Among other secular buildings are the Grashaus, built 1267, the old and New Kurhaus, a museum and a theater. The squares are decorated with fountains and statues. Aachen produces textiles, goldsmith work, glass, iron ware and honey cakes. There is also active trade. The mineral springs are efficacious in treating skin diseases, rheumatism, gout and neuralgia. Besides the technological institute, there are advanced and vocational schools of all kinds. Pop. 1925, 155,816.

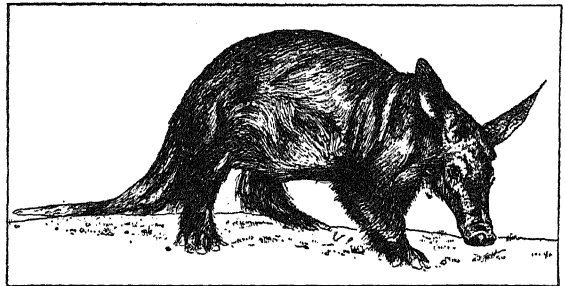
**AAKJÄR, JEPPE** (1866- ), Danish poet and novelist, was born at Aakjär in Jutland, Sept. 10, 1866. The son of a farmer, he owned and operated a farm in addition to carrying on his literary work. Much of his work has been written in the native dialect of his district. The best known collection of his poems is *Songs of the Rye*. Many of his poems have been set to music. Aakjär has written several novels, including *The Peasani's Son*, *The Children of Wrath*, *Pension* and a biography of STEEN STEENSEN BLICHER, the poet.

**AALBORG**, a seaport of North Jutland, in Denmark, an old city situated on the Limfjord, which connects the Kattegat with the North Sea. It has had privileges as a town since the 14th century. The city has many interesting old buildings, a shipyard and cement works, also textile mills, distilleries, chemical works, and a tobacco factory. Pop. 1930, 44,545.

**AARAU**, a city of Switzerland, capital of the canton of Aargau, situated on the Aare. It has a large cantonal library with rare manuscripts and incunabula, and natural history, historical and ethnological mu-

seums, while an ancient tower, the Rathaus and other quaint buildings give it a picturesque aspect. Aarau is an industrial city and its cutlery, mathematical instruments, bell and cannon foundries are renowned. Mentioned in 1267, the city was granted municipal rights by Rudolph of Hapsburg in 1283 and in 1415 was transferred from Austria to Bern. In 1798 it became capital of the newly founded canton. Pop. 1930, 11,612.

**AARD-VARK** (*Orycteropus capensis*), a Dutch name, signifying earth hog, for an edentate mammal found exclusively in Africa. Its body resembles that of a pig, being thick, with thick, short legs and neck, and its head has a long snout, at the end of which is a disk. Its mouth is tubular and its ears extremely long. The tail is thick at the base, but tapers sharply. The hair is coarse and bristly. The fore feet are fur-



COURTESY AMER. MUS. OF NATL. HISTORY

AARD-VARK, OR EARTH HOG, OF SOUTH AFRICA  
*Orycteropus capensis*

nished with four strong claws and the hind with five, which are used for burrowing for white ants on which it feeds. If pursued, it is able to excavate for itself a hiding place with great swiftness and once thus entrenched it is exceedingly difficult to dislodge. The flesh is edible but not appetizing. Aard-varks are found in eastern Africa from Cape Colony to Egypt and several species have been described.

**AARD-WOLF** (*Proteles cristatus*), a name, signifying earth wolf, for a south and east African carnivorous mammal belonging to the sub-family *Protelidae*, related to the *Hyenidae*. It resembles the fox in size and habits, but its sloping back is like that of the hyena, its color and markings being also similar. It feeds on decomposed animal carrion and on white ants. It is nocturnal in its habits and inoffensive and when pursued usually burrows a hiding-place.

**AARHUS**, the second largest city of Denmark, situated on the sheltered Aarhus Bay, and the principal seaport of Jutland. It is next in size and importance to Copenhagen. Aarhus has been a bishop's see for many centuries; St. Clemens, the Gothic cathedral erected in the 13th century, was the first one in Denmark. A unique feature of Aarhus is Old Town, an open-air museum, consisting of old buildings assembled from all parts of the country and re-erected to form a town. These houses are furnished with rare and contemporaneous furniture. Agricultural products are the chief exports. Coal and iron are imported in large quantities to maintain the extensive manufacturing industries. Pop. 1930, 81,517.

**AARON**, the first high priest of the Hebrews. Belonging to the tribe of Levi, he was the son of Amram and Jochebed. His elder sister was Miriam and his younger brother was Moses. His birth in Egypt seems to have antedated Pharaoh's edict to slay the male children of the Israelites, but he lived in obscurity until he had passed the age of 80, when Moses returned to deliver his fellow countrymen from bondage. In the emancipation of the Hebrews, Moses was the leader but, being slow of speech, he used Aaron as spokesman. It was Aaron by whose rod miracles, including the plagues of Egypt, were performed. When Moses withdrew into Mount Sinai to receive the Ten Commandments, Aaron was persuaded by the people to set up the golden calf (*see* APIS) which Moses destroyed. At the founding of the tabernacle, Aaron became high priest, which office was reserved strictly for his descendants. Other Levites, Koran, Dathan and Abiram, challenged this ecclesiastical precedence and themselves sought to offer incense. With 250 followers, they were swallowed up in a pit, and a plague sweeping over the camp of the Israelites cost 14,700 lives. In order to reinforce Aaron's authority, Moses laid 12 rods in the sanctuary, each representing a possible aspirant to the priesthood. It was Aaron's rod that budded or broke into blossom, thus proving Aaron's claim to authority.

Dying at the age of 123 years, Aaron was buried on Mount Hor, where a white domed mosque marks his traditional tomb. The high priesthood continued in the house of Eleazar until the time of Eli, when it passed to the family of Ithamar. But in the time of Solomon it reverted to the elder line, represented by Zadok, and so continued until the destruction of Jerusalem.

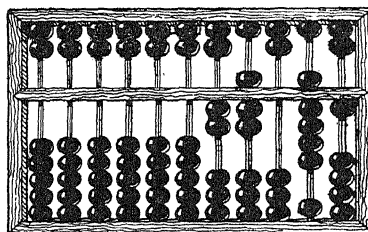
**AARON'S-ROD**, a name popularly given to various plants with tall stems bearing long narrow flowering spikes, as certain goldenrods (*Solidago*) and the great mullein (*Verbascum Thapsus*). The orpine (*Sedum triphyllum*) is also known as Aaron's-rod.

**ABACA** or **MANILA HEMP** (*Musa textilis*), a large tree-like herb of the banana family yielding one of the most valuable of cordage fibers. It is a native of the Philippine Islands where it is very extensively cultivated, the fiber constituting a leading article for export. The plant grows usually from 10 to 25 ft.

high producing from an underground root-stock clusters of long, sheathing leaf-stalks which bear huge, undivided leaves similar to those of the banana; numerous flowers in long nodding spikes on a central stem, and a berry-like, many seeded, inedible fruit. At the age of about three years the flower-clusters appear. At this stage the central stalk is cut down; the sheathing leaf-stalks are torn apart and cut into small narrow strips. While still fresh the strips are drawn between a knife-like instrument and a hard wooden block. By continuous scraping the soft pithy material surrounding the fiber is removed. After being dried in the open air, the cleaned fiber is ready for the market. The coarser fibers are used for marine and other cordage where great strength and durability are required. The finer fibers are woven into muslin, grass cloth and various light textiles. Besides its chief uses for cordage and textiles, abaca is utilized for numerous other purposes.

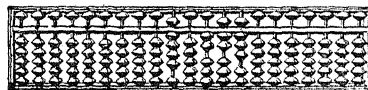
The annual crop of abaca or manila fiber in the Philippine Islands usually exceeds 350,000,000 lbs. In 1930, 138,505,920 lbs., valued at \$8,512,000, was exported to the United States.

**ABACUS**, a primitive instrument for calculating. The word is from the Greek *abax*, table, or possibly from the Hebrew *abq*, dust, referring to the dust



CHINESE ABACUS

sprinkled on a tablet, thus permitting of making marks as on a slate. The abacus with beads or counters was used by the Egyptians, Greeks and Romans, being inherited from the latter by the European



JAPANESE ABACUS

countries generally. At present the countries making the most extended use of the instrument are China, Japan and Russia. The Chinese and Japanese types are here shown. *See* CALCULATING MACHINES.

**ABALONE**, the name given in California to sea snails belonging to the family of ear-shells or sea-ears (*Haliotidae*). They frequent rocky places between the tide marks. Several species live on the western coast of the United States, and others are found on most temperate shores, except the eastern coast of the Americas. Some of them are very good to eat, particularly the California abalones, and the ormer, from the Channel Islands, England.

The abalone shell is a flat spiral, shaped like a human ear, with a row of holes along the back. It is lined with exceptionally fine mother-of-pearl. When the animal is moving its fringed mantle borders the shell in a most attractive manner, and little tentacles protrude through the holes, but when it is still it can draw itself completely under the protecting shell. It has a powerful adherent foot with which it clings to the rocks, so that it is very difficult to pry loose. The shell is valuable for its mother-of-pearl, which is used for making inlays, buttons and even jewelry, while the snails themselves are dried and shipped in large quantities to Japan and China where they are considered great delicacies.

**ABANDONMENT**, in law, an act intended to relinquish a property right. The term has a technical meaning, but intention, not accident or carelessness, must be clearly shown. How far lapse of time evidences abandonment is a question of fact for the jury. The burden of showing abandonment rests upon the one who asserts it. Most authorities hold that the intention to abandon cannot be inferred from "non-user" alone, a case in Vermont going so far as to hold that "failure to exercise ownership for thirteen years does not show abandonment." Except in the case of a perfect title to an inheritable interest in land, any right to ownership of property may be lost by abandonment.

Abandonment as between husband and wife is commonly known as desertion, and in a number of states of the U.S. is sufficient ground for DIVORCE. In New York, it entitles the successful litigant to a legal separation from bed and board. This subject is governed by STATUTES. The voluntary separation of one spouse from another without cause and without the other's connivance, and with the intention of not returning, constitutes desertion. However, the abandonment must be complete, no visits permitting cohabitation, and it must be self-imposed, not caused by imprisonment.

**ABASIA**. See **ABKHASIA**.

**ABATEMENT**, in law, is used in many senses. The following are most important. In pleading, in an action at law, it denotes the effect upon the action of a plea setting up matters of fact which show that the unit, or basis of the action, is defective or incorrect. If the plea is established, the action is defeated. But the plaintiff may proceed or bring a new action when the defect is obviated. In equity pleading it denotes the termination or suspension of proceedings in a suit in equity because of death of one of the parties or other event whereby there are not proper parties to go on with the cause. In the law of administration of estates, it refers to a proportionate reduction of money legacies where the assets available do not suffice to pay them in full, or of debts where the available assets are insufficient to pay all creditors in full. In the law as to nuisances it denotes a physical removal of the offending thing.

**ABBASIDS, THE**, a dynasty of Mohammedan caliphs which seized the caliphate from their predeces-

sors the Umayyads in 750. They traced their descent from an uncle of Mohammed. The Abbasids transferred the capital of the Mohammedan dominions, except Spain, from Damascus to Bagdad where was fulfilled the most glittering period of Mohammedan civilization. The court of Harun al Rashid (786-809) was the object of envy and imitation by the Byzantines and Charlemagne. Their power dwindled to nothing under political dismemberment and the rise of the Sultan. The latter, originally commander of the barbarian troops in the capital, from 940 forced the caliph to confine himself to his religious duties. The destruction of Bagdad by the Tartars in 1258 ended even these duties. Remnants of the family retained the title of caliph until the Sultan Selim I transferred it to himself in 1517.

**ABBESS**, the female superior of certain communities of nuns (see **ABBOT**). According to the Council of Trent, an abbess is elected by the sisters and, apart from exceptional circumstances, must have reached her fortieth year and the eighth year of her profession. Broadly, the authority of an abbess is "domestic" only. As a woman, she does not exercise the functions and jurisdiction reserved for an abbot, bishop or priest. For instance, she may exhort, but she must not preach. In Germany certain Lutheran sisterhoods, once Catholic, are still governed by abbesses, and in Austria in 1755 the Empress Maria Theresa founded a secular institute for impoverished noblewomen whose abbess had to be an archduchess over 18 years of age.

**ABBEVILLE**, a cloth-manufacturing town, situated on the River Somme, department of Somme, northern France. In the Middle Ages it was an important fortified center. Abbeville, situated 12 mi. inland from the English Channel, played a significant part in the prolonged English wars in France and several notable events took place within its walls, one of them the signing of the treaty by which the English, in 1259, renounced Normandy. Earlier, it had been a rendezvous for the chiefs of the first two Crusades. Its church of St. Vulfran is a good example of late-Gothic architecture. In the World War several important consultations between Allied leaders were held at Abbeville. The town was damaged in the air bombardments of 1918. Pop. 1931, 19,335.

**ABBEY, EDWIN AUSTIN** (1852-1911), American mural painter, was born at Philadelphia, Apr. 1, 1852. He showed an early interest in the work of the artist, at 16 began the study of wood carving, and later studied at the Pennsylvania Academy of Fine Arts. In 1871 he became a staff illustrator for *Harper's Weekly*; in 1878 he was sent by *Harper's* to England to illustrate the poems of Robert Herrick. Abbey became popular as an illustrator in black and white and as a painter of water colors and pastels. His first large canvas, *A May Day Morn*, exhibited at the Royal Academy in 1890 established his reputation in oils. In 1901 he was commissioned to paint the Coronation of Edward VII. In America his *King Lear's Daughters*, 1898, is in the Metropolitan Mu-

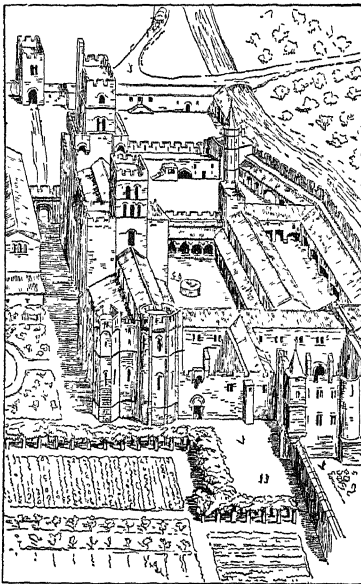
seum, New York; his *Penance of Eleanor, Duchess of Gloucester*, 1909, in the Carnegie Institute Museum, Pittsburgh, Pa.; his famous mural, *The Quest of the Holy Grail*, in the Public Library, Boston; and his *Apotheosis of Pennsylvania* in the State Capitol, Harrisburg, Pa. He was a member of the National Academy of Design, New York, the Royal Academy, London, a Chevalier of the French Legion of Honor and was the recipient of gold medals in Europe and America. Abbey died in London, Aug. 1, 1911.

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**ABBEY**, the term inclusively applied to the buildings of a monastery. It therefore connotes an important influence in the development of architecture in western Europe. Although Christian anchorites early adopted group life, Western monasticism owes its spread, as it traces its vital beginning, to Benedict of Nursia (b. 480), who founded the great Benedictine Order, and established therewith a rule of conduct and a scheme of building, which became synonymous with Western European monasticism. Organizing his first small communities in the hills near Subiaco, Benedict took several disciples of Monte Cassino, midway between Rome and Naples, and there established the great parent house of the Benedictine rule. The order spread quickly through Italy, France, Spain, England and Germany. By the time of the

and developed medieval church architecture, perfecting the Romanesque forms, and making the first experiments in Gothic structure.

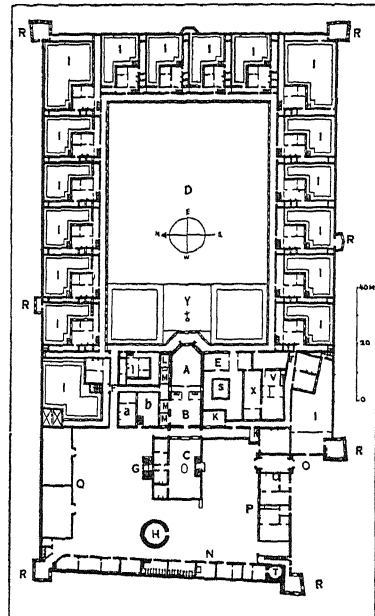
The basic monastic rule, laid down by St. Benedict, was that of a self-contained community about a religious center. Therefore the abbey, with the church as its nucleus, must contain all the buildings necessary for maintaining the common life; mill, bakehouses,



E. VIOLLET-LE-DUC, DICTIONNAIRE RAISONNÉ DE L'ARCHITECTURE FRANÇAISE

ABBEY OF ST. ALLYRE, CLERMONT-FERRAND, FRANCE

Council of Constance, 1415, the Benedictine abbeys of Europe numbered more than 15,000. Meanwhile, other orders had been founded, for the reform of luxuries or abuses which had crept into Benedictine practice, and the exigencies of these newer rules inevitably affected the building of the new abbeys. The abbeys of the different monastic orders kept church building a living art through the Dark Ages,



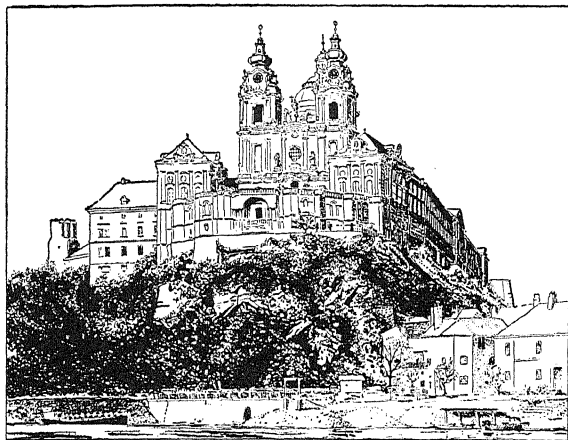
FROM E. VIOLLET-LE-DUC, DICTIONNAIRE RAISONNÉ DE L'ARCHITECTURE

PLAN OF THE RESTORATION OF "LA GRANDE CHARTREUSE," NEAR CLERMONT-FERRAND, FRANCE

A, Sanctuary; B, monks' choir; C, court; D, main yard, surrounded by the galleries of the cloister, giving access to the cells (I), each forming a little separate lodging with a garden; E, council room; F, passage; G, prior's quarters; H, tower, used as a pigeon house; K, chapel of Pontgibaud; L, sacristy; M, chapel; N, stables with rooms for coachmen; O, entrance; P, guest rooms; Q, granaries; R, watch-tower; S, little interior cloister; T, bake-house; V, kitchens; X, refectory; Y, cemetery; Z, prison; a, cell of under-superior with its little garden, b

stables, workshops, as well as dwelling-places and church. The buildings were arranged in groups: the large church, with the important feature of a cloister to the south, about the covered walks of which were arranged the monks' living quarters, refectory, a common room for social meetings and a chapter-house for discussion and conference; not far away, the group comprising the infirmary, novices' school and guest houses for distinguished visitors, other monks and the poor. The kitchen, mill, stable and the like were separated from the other buildings, but were all enclosed by a wall which served the purpose not only of isolation but of necessary defense. The early Benedictine monasteries have disappeared, but an excellent plan of the Abbey of St. Gall, Switzerland, remains to acquaint us with the typical Bene-

dictine plan. Canterbury Cathedral and Westminster Abbey were erected for Benedictine monasteries. The earliest important Romanesque building still standing in Normandy, Jumièges Abbey, was also Benedictine,



BENEDICTINE ABBEY AT MELK, ON THE DANUBE, AUSTRIA, ONE OF THE MOST LAVISH OF BAROQUE ABBEYS

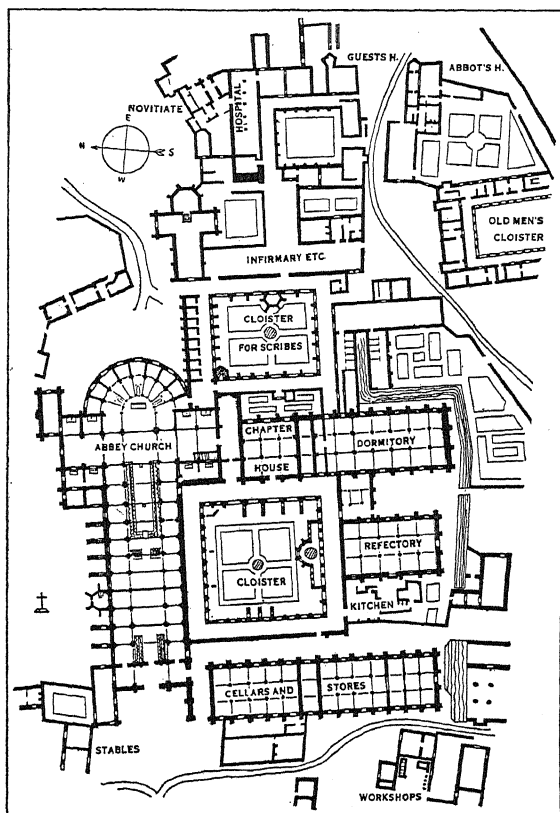
as were the abbey churches of Caen, and the celebrated abbeys of Mont-St. Michel and Fontevrault. Benedictine abbey churches were built with towers and with apsidal eastern ends.

The various abbeys were independent of each other, and in each abbey the rule of the abbot was supreme. Moreover, in that early feudal day, the monastery became of necessity a feudal entity, the abbot a feudal lord. By the 10th century the observance of the rule had fallen into laxity. In the year 909 the Cluniac Order was established; its control centered in the great Abbey of Cluny in Burgundy, to which all Cluniac monasteries owed obedience. By the end of the 12th century the order of Cluny numbered more than 300 of these monasteries of reformed Benedictine rule, and 10,000 monks are said to have been under the authority of Cluny's abbot.

The most conspicuous feature of the Cluniac reform was increased emphasis upon the church offices. We find therefore that the church occupied a place of imposing predominance in the abbey group. The Abbey of Cluny was the largest Romanesque church in France. It had the long eastern end and double transept which came to be characteristic of later churches; and, to accommodate lay pilgrims whom the monks did not admit to the church proper, it had a large enclosed porch, or narthex. The Abbey of Cluny was almost totally destroyed during the French Revolution, but plans make its scheme familiar, and the Cathedral of Autun, also in Burgundy, is almost a copy, though smaller. The most interesting abbey church of the Cluniac order now standing is that of Vézelay, which was consecrated in 1104, and from which, in 1146, the French king sounded the call to the Second Crusade. This church, too, is large (there were 800 monks at Vézelay), and has the enclosed narthex of other Burgundian abbey churches.

As for the Abbey of Cluny itself, it housed a community of 400 monks. The abbots of such communities were great lords; and inevitably the success of the reformed movement brought defeat to the actual reform. The order grew rich and mighty, discipline relaxed, and a new reform followed.

The Cistercian rule, established in 1098 at Cîteaux near Dijon, brought a marked departure from both the Benedictine and Cluniac procedure, and consequent architectural changes. Some of these were explicitly demanded by St. Bernard, who, although not the founder of the order, was its greatest leader, and made his Abbey of Clairvaux its greatest center. The



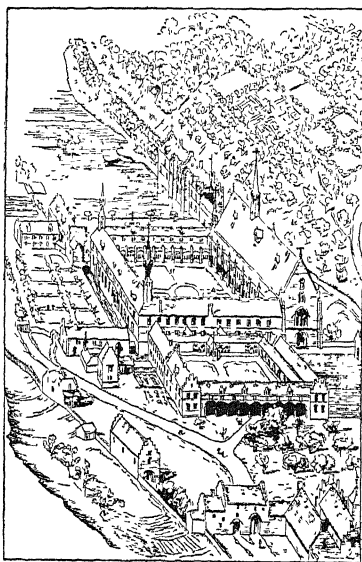
E. VIOLETT-LE-DUC, DICTIONNAIRE RAISONNÉ DE L'ARCHITECTURE FRANÇAISE  
PLAN OF THE OLD CISTERCIAN ABBEY OF CLAIRVAUX, FRANCE

heart of the Cistercian reform was a return to primitive simplicity, and the establishment of an austerity which went beyond that of the first Benedictines. St. Bernard ruled that this simplicity must extend to the churches; there must be no tall spires, only one, central tower, very low; eastern ends short and preferably square; neither stained glass nor ornamental tracery in the windows; and no sculpture, ornamentation, or unnecessary architectural detail; even the crosses must be of plain wood. Other changes in building grew out of new features in the monastic life.

The Cistercian Order established its monasteries in wild and remote valleys, cleared forests, reclaimed swamplands, conquered wild beasts and brigands, cultivated the soil, raised cattle, horses and sheep.



Such work necessitated the admittance of large numbers of lay brothers, and to accommodate them the churches, like the communities, must be large. These churches had additional chapels, divided by solid walls, and sometimes several additional altars. The abbeys were strongly fortified, and the strictly monastic buildings were separated from the farm and workshop departments by a wall. There was a separate library. The refectory was always placed at right angles to the nave of the church, not parallel to it as in Benedictine abbeys, in order to keep the sounds and odors of eating as far as possible from the sanctuary. Fountains Abbey is one of the largest and best preserved Cistercian establishments in England, and Tintern Abbey is also Cistercian. An interesting French example, standing in what is still a valley at



VIOLET-LE-DUC. DICTIONNAIRE  
AUGUSTINIAN MONASTERY OF SAINTE-  
MARIE DES VAUX-VERTS NEAR BRUS-  
SELS

some distance from highways, is the Abbey of Fontfroide, between Narbonne and Carcassonne.

The Cistercian Order exerted a strong influence upon architectural development, especially in rural churches. It was through the Cistercians that Gothic architecture was carried from France to Italy. And although it is a mistake to credit the Cistercians with the actual introduction of the square east end to church architecture in England, the rule of St. Bernard undoubtedly had much to do with its almost universal adoption there. In the Ile de France, and generally in French cities, church builders were not moved to follow Cistercian severity. But the South of France contains many noteworthy country churches which were once attached to Cistercian monasteries.

At about the same time as the Cistercian rule, the Carthusian Order was established, by St. Bruno, about 1084, in the mountain fastnesses of the Chartreuse, near Grenoble. In this most austere of the great monastic foundations, the brothers lived in

silence and solitude, each with his own self-contained cell and garden, which he never left except for church services and to meet with his fellows on certain appointed days. The architectural plan, as seen at Clermont in France, was virtually the same in all these monasteries. Three-roomed cells, really cottages joined together, surround three sides of the cloister or central court. On the fourth side are the church, chapter house, monks' choir and refectory, each relatively small, and adjoining are the house and garden of the prior. Watch-towers stand at the corners and in the middle of the outer wall. The monks' cottages are so arranged that no sound comes from neighboring cells. As time went on the severity of the Carthusian rule was relaxed, and the abbeys permitted such elaboration of decoration as characterize the magnificent Certosa of Pavia. But the building scheme remained the same.

It is to the monasteries, and to the basic monastic rule, that we owe one of the most beautiful details of medieval, or any other, architecture. Sometimes very plain, but more often permitted the play of fancy, the free quest of loveliness, the whimsical suggestion of the grotesque, elaborate like Cadouin, verdantly peaceful like Moissac, splendid like Monreale, the abbey had its CLOISTER, a unique contribution to the development of architecture.

K. W.

**ABBOT**, the superior of certain religious communities of men with 12 or more monks (*see* MONASTICISM; ABBEY; ABBESS). The word is derived from *Abba* (Mark 14:36), the Syriac form of the Hebrew *Ab*, father. By tradition abbots, as for example among the Benedictines, were elected by the monks themselves, and although during the Middle Ages powerful monarchs asserted a right of nomination the freedom of election was restored at the Council of Trent, 1545-63. A candidate has to be at least 25 years of age, a priest and a professed member of the order. According to authority exercised, abbots regular are classed in three grades: first, abbots of quasi-episcopal status, whose independent jurisdiction *abbatia nullius* lies apart from any diocese; second, abbots whose jurisdiction, though extending beyond their community, is included in a diocese administered by a bishop; and third, abbots whose jurisdiction is limited more or less strictly to the abbey itself. "Titular abbots" are appointed to an abbey that has disappeared. As a rule an abbot has the right to use pontifical insignia, the mitre, crozier, pectoral cross, ring, gloves and sandals. He is permitted to give the tonsure, that is, to receive a baptized and confirmed Christian into the clerical state.

**ABBOTSFORD**, the famous country seat of Sir Walter Scott in Roxburghshire, Scotland, on the Tweed. It is about 3 mi. west of the Abbey of Melrose, once the ancient peasant holding Cartley Hole, which Sir WALTER SCOTT purchased and gradually transformed into a romantic house in castle style. It still contains the library and other rich collections and souvenirs of the author, who died there in 1832. Washington Irving describes the castle in his *Miscellanies*.

**ABBOTT, JACOB** (1803-79), American educator and author, was born at Hallowell, Me., Nov. 14, 1803. He graduated at Bowdoin College in 1820 and later studied theology. In 1820-21 he taught at Portland Academy where Longfellow was his pupil, and in 1825 became professor of natural philosophy at Amherst. He founded Mt. Vernon, one of the first American schools for young women, at Boston, but resigned the principalship in 1834 to become minister of the Elliot Congregational Church, Roxbury, Mass., the birthplace of his son, LYMAN ABBOTT. His children's books include *The Young Christian* and 28 volumes of the *Rollo* series. Abbott died at Farmington, Me., Oct. 31, 1879.

**ABBOTT, SIR JOHN JOSEPH CALDWELL** (1821-93), Canadian statesman, was born at St. Andrews, Lower Canada, Mar. 12, 1821. After graduation from McGill College, Montreal, he became a lawyer and subsequently was dean of the McGill law faculty for ten years. His political career began when he signed the annexationist manifesto in 1849, but he lived this down to become member of the Legislative Assembly of Canada in 1857 and of the Canadian House of Commons in 1867. Implicated in the "Pacific Scandal" he was defeated in the election of 1874, but returned to the House of Commons in 1880, and in 1887 to the Senate. Following the death of Sir John A. Macdonald, he was Conservative prime minister from June to December, 1891, resigning on account of ill-health. He was knighted in 1892.

**ABBOTT, LYMAN** (1835-1922), American clergyman and editor, was born at Roxbury, Mass., Dec. 18, 1835. He was graduated from New York University in 1853, practiced law in New York until 1859, then studied for the ministry and was ordained in 1860. He served as pastor at the Congregational Church, Terre Haute, Ind., 1860-65; New England Church, New York, 1866-69; and succeeded Henry Ward Beecher as pastor of the Plymouth Congregational Church, Brooklyn, in 1887, where he remained until 1899. His books include a biography of Henry Ward Beecher whom he joined in 1876 as co-editor of the *Christian Union*, renamed *The Outlook* in 1893. His progressive ideas for social and political life appeared in this magazine until his death at New York, Oct. 22, 1922.

**ABBREVIATION**, use of an incomplete form of a word in place of the word itself. Certain letters may be omitted from within the word, or only the initial letter or letters may be used, as *lbs.*, *e.g.*, *viz.* An abbreviation should be distinguished from a contraction, a shorter form of a word which becomes a new word in its own right, as *bus* instead of *omnibus*.

**BIBLIOGRAPHY.**—J. Wilson, *Treatise on English Punctuation*, 1871; G. Summey, *Modern Punctuation*, 1919.

**ABBREVIATORS**, high officials of the papal court. Doubtless as a precaution, the early Christians abbreviated words and sentences in their documents. The practice continued at Rome where, for instance, the Apostolic Chancery omitted the diphthongs *æ* and *œ*, also eliminating punctuation from their parch-

ments; hence, the appointment of "abbreviators," whose profession it was to subject official and other writings to accurate abridgment. For many centuries the abbreviators enjoyed great dignity, and as domestic prelates of the Roman Court held precedence in all dioceses throughout the world, being addressed as "reverendissimus," "right reverend" and "monsignor." Abbreviators of the Greater Presidency received from Pope Benedict XV the privilege of wearing a hat with a purple band. The abbreviators are no longer in existence.

**A B C POWERS**, three South American states, viz., Argentina, Brazil and Chile, outstanding among the countries of Latin America in political and social achievement. At one time or another they have sought to exert a greater influence in Latin American affairs by close diplomatic collaboration and concerted action in times of crisis involving Latin American states. Thus, when war seemed imminent between the United States and Mexico in 1914, they tendered their good offices.

**BIBLIOGRAPHY.**—G. H. Stuart, *Latin America and the United States*, 1922.

**ABDERA**, a town of Thrace, surviving in extensive ruins. It was located near the mouth of the Nestus which flowed through it. Hercules, who is said to have named the city for his favorite, Abderus, was the mythological founder. The historical founder was Timesius of Clazomenae who settled here about 656 B.C. After the Thracians had expelled Timesius, fugitives from Persian rule in Teos sought refuge here in 544 B.C. Under the Persians and later under the Romans, Abdera became a town of importance. However, its inhabitants were considered stupid, and "Abderite" was an appellation for persons of little sense. Democritus and Protagoras were born here.

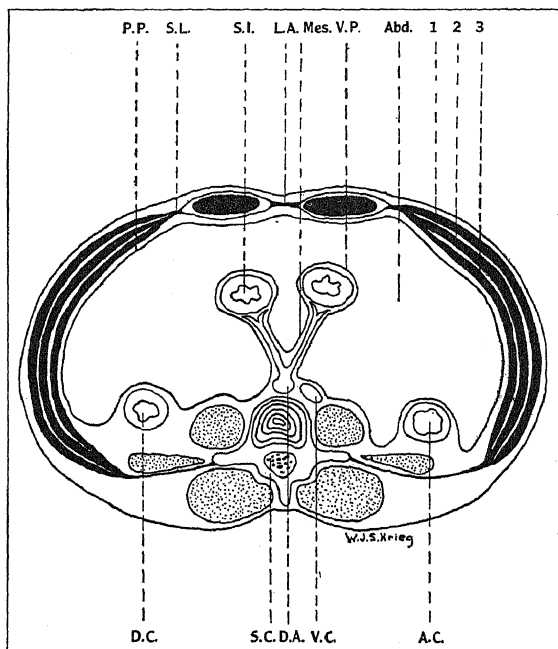
**ABDICATION**, in its modern usage, the formal or actual renunciation of office by the head of a sovereign state. The use of the term has generally been confined, however, to acts of non-elective executives as kings, queens, emperors, sultans and dictators. Similar action on the part of the elected head of a republic is usually referred to as resignation. Technically the term abdication implies that the decision to vacate the office was voluntary. Actually, many abdications have in reality been involuntary, forced by a set of events which made any other course impossible.

**BIBLIOGRAPHY.**—*Encyclopedia of the Social Sciences*, 1930.

**ABDOMEN**, name applied to that part of the trunk of the body which is in front of the vertebral column and below the thorax. It includes two parts, the abdomen proper and the pelvis. It is bounded above by the diaphragm, below by the pelvic diaphragm, behind by the vertebral column and its muscles, in front and on each side by the skin, muscles, fascias of the body wall: the pelvic part is surrounded in addition by the bony pelvic girdle.

The abdomen is made up of (1) body wall, (2) body cavity, and (3) the viscera and vessels contained within the cavity.

(1) The body wall is especially modified in the abdomen in several ways. First: the ribs are suppressed, just as in the neck, to allow the free bending and twisting movements of the waist. They are represented only by the short transverse processes of the lumbar vertebrae. The muscles are arranged in three layers, and these, not being interrupted by ribs as in the thorax, form continuous sheets, the external oblique muscle, the internal oblique, and the transverse. Their fibers run in different directions, and their main use, beside compression of the abdomen, is to move the upper part of the trunk into desired positions and hold it there, fixing the thorax as a base for all forcible action by arms, shoulders,



DIAGRAMMATIC CROSS SECTION OF THE HUMAN ABDOMEN

Abd., abdominal cavity; A.C., ascending colon; D.C., descending colon; D.A., aorta; L.A., linea alba; Mes., mesentery; P.P., parietal layer of peritoneum; S.C., spinal canal; S.I., small intestine; S.L., semilunar line; V.C., inferior vena cava; V.P., visceral layer of peritoneum; 1, 2, 3, respectively, external oblique, internal oblique, and transversalis muscles

or head. Near the anterior median line these muscles are all inserted into a tough pliable membrane made by the interweaving of tendon fibers. (*S.L. in figure.*) This arrangement gives strength, even in the absence of bone and permits the utmost mobility. This membrane of insertion is split into two layers, external and internal, which inclose between them a fourth muscle—the vertically extending rectus (*Rec.*). Second: the bony pelvic girdle originally formed in the superficial fascia, sinks into the muscle layer of the body wall, interrupting it and separating it into an upper part just described, and a lower part below the pelvic girdle, made of the levator-ani and coccygeus muscles so arranged as to constitute the pelvic diaphragm. Between these upper and lower groups of muscles the bony pelvic girdle is interposed forming the wall of the pelvis.

(2) The body cavity of the abdomen presents two great modifications. First: it is separated in mammals by the dome-shaped muscular diaphragm, from the body cavity of the thorax. The diaphragm thus helps the body wall muscles in compressing the abdomen, producing in it the very great pressure necessary in mammals for parturition, and from which the heart and lungs, being above the diaphragm, are exempt. Second: the right and left sacs, into which the body cavity of the thorax is separated, are continuous in the abdomen, because the partition between them is lacking in the lower part of the abdomen in front of the intestine. The lining of the body cavity called the pleura in the thorax, is in the abdomen called peritoneum. Both are smooth, slippery, serous membranes, permitting free movement between the viscera and the walls. The outer or parietal layer of each constitutes the innermost layer of the body wall: the inner or visceral layers are reflected over the viscera to form their outermost coverings, called serous coats or tunics.

(3) For convenience in medical and surgical work, the abdomen is subdivided into nine regions, and the viscera contained in each are shown in the following table:

(UPPER)		
<i>Right Hypochondriac</i>	<i>Epigastric</i>	<i>Left Hypochondriac</i>
Liver, colon, right kidney.	Stomach, liver, gall-bladder, pancreas, duodenum, suprarenal glands, kidneys.	Stomach, spleen, colon, left kidney.
(MIDDLE)		
<i>Right Lumbar</i>	<i>Umbilical</i>	<i>Left Lumbar</i>
Colon, right kidney, small intestines.	Colon, great omentum, duodenum, small intestine, kidneys.	Colon, great omentum, small intestines, left kidney.
(LOWER)		
<i>Right Inguinal</i>	<i>Hypogastric</i>	<i>Left Inguinal</i>
Colon, caecum, vermiform appendix	Small intestine, bladder (if distended), uterus (if distended).	Colon
PELVIS		
Rectum, uterus and Fallopian tubes, ovaries, urinary bladder, prostate, seminal vesicles. Small intestine (if the other viscera are not distended).		

B. C. H. H.

**ABDUCTION**, the taking or carrying away a child, ward, or wife for immoral or other purposes. Many years ago England enacted statutes punishing the taking away of females. In the United States certain STATUTES have been adopted as the COMMON LAW of the land, when not inconsistent with American institutions. The salient features of the laws are, that the woman must be "taken" away by fraud or force from a secure place. The laws were particularly made to prevent young women being lured into conditions of concubinage or PROSTITUTION.

**ABDUR RAHMAN KHAN** (1844-1901), Amir of Afghanistan and maker of that country as it exists to-day. His grandfather Dost Mohammed died in 1863, leaving three sons, Afzul, Azim, and Shere Ali. After a series of wars between the brothers, in which Britain and Russia became involved, Abdur, the son of Afzul, became undisputed amir in 1881. His punishments were ruthless, but the amir's rule was roughly equitable and under it life and property were safe. It was his opinion that Afghanistan might pay too high a price for encouraging foreign trade and his policy aimed rather at freedom from such entanglements. He died Oct. 3, 1901, his son Habibullah being proclaimed his successor (*see* AFGHANISTAN; AMANULLAH KHAN).

**ABEL**, a Biblical character in the Book of Genesis, the second son of Adam. For his death, *see* CAIN.

**ABELARD, PETER** (1079-1142), French scholastic philosopher, and greatest teacher of history of his time, was born at Pallet, near Nantes, France, in 1079. He studied with Roscellin, the Rationalist, and later entered the Cathedral School of Notre Dame in Paris, where he was the pupil of William of Champeaux, the Realist. Disagreeing with the latter's teachings, he left the school to lecture and expound his own doctrines, thus starting an embittered controversy of long duration with his former teacher which ultimately led to William's downfall. Students flocked to hear Abélard wherever he spoke. He opened a school at Melun, which he moved later to Corbeil. In 1113 he decided to study theology with Anselm of Laon. Again he flouted the theories of his teacher and gave rival lectures near the school. In 1115 he returned to the Cathedral School to lecture and for three years was idolized by his students, who came from far and wide. Then came his tragic love affair with Héloïse, a pupil and the niece of Canon Fulbert. Though he married Héloïse after the birth of their son, her uncle soon separated them and Abélard entered a monastery at St. Denis in Paris. Here he continued his lectures, but in 1121 was accused by the Synod of Soissons of being a heretic and was imprisoned for a time.

The following years were marked by continued persecution for his theological views, and he spent some time as a hermit near Nogent-sur-Seine and 10 years in an abbey in Lower Brittany. During this period he wrote his *Historia Calamitatum* (*The Story of His Disasters*). In 1141 he was accused of heresy by the Council of Sens. Though sentenced to prison, he was finally allowed to enter the monastery of Cluny. He died at Chalon-sur-Saône Apr. 21, 1142. Abélard is considered by many as the founder of the University of Paris. M. R.

*See* J. McCabe, *Life of Peter Abelard*; Townsend, *Great Schoolmen of the Middle Ages*, 1881.

**ABELIAN FUNCTIONS**, so named from Niels Henrik Abel (1802-29), are a generalization of the ELLIPTIC FUNCTIONS in which the comparatively simple elliptic integrals are replaced by integrals of a more general type. The integral of any algebraic function

is called an Abelian integral. If  $y$  is a given algebraic function of  $x$  defined by the equation  $f(x, y) = 0$ , then all integrals of the form  $\int r(x, y)dx$  where  $r$  is rational in  $x$  and  $y$  may be said to belong to the same type.

The Abelian functions, to which resort is made in the study of Abelian integrals, involve  $m$  independent variables and are characterized by periodicity of order  $2m$ . When  $m = 1$  they become elliptic functions. When  $m = 2$ , they are called hyperelliptic functions.

*See* H. F. Baker, *Abelian Functions*, 1897.

**ABEL TEST**, a test made principally on lamp oils to determine the flash point, which is the temperature at which vapors are given off in such proportions that they form an inflammable mixture with air. Originally developed in 1875 by F. A. Abel, an English chemist. The apparatus now used is known as the Abel-Pensky tester and consists of a heated water-bath, in the top of which is suspended a sample test cup closed by a segmental cover equipped with a clockwork mechanism for opening and closing it and for applying a standard flame to the sample.

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**ABENEZRA**. *See* IBN ESRA.

**ABERCROMBIE, LASCELLES** (1881- ), English poet, was born at Ashton-upon-Mersey, Cheshire, Jan. 9, 1881. He lectured on poetry and English literature at the University of Liverpool and at Leeds. *Interludes and Poems*, his first book, appeared in 1908. Besides a number of other volumes, including *Mary and the Bramble*, 1910, and *Deborah*, 1912, Abercrombie has published a critical work on THOMAS HARDY and various studies of poetry.

**ABERDARE**, a city in Glamorganshire, Wales, in the beautiful Cynon Valley, 12 mi. northwest of Pontypridd. It has the handsome 14th century Church of St. Elvan, important coal mines and iron works. Pop. (of district and town) 1921, 55,007; 1931, 48,751.

**ABERDEEN**, royal burgh, city and seaport capital of Aberdeenshire, Scotland, lying between the mouths of the Dee and Don rivers, about 129 mi. northeast of Edinburgh. It has always been one of the most important Scottish cities, its historical records running the gamut of the stormy history of the land. The great cathedral, begun in the 14th century, is of granite, and so unique in the British Isles. Its central tower, collapsing in 1688, destroyed the choir and transept, but the roof of the 16th century nave and a great west window remain among other fine features. The 13th century "auld Brig o' Balgownie" over the Don, and the university of the 15th and 16th century foundation, are among Aberdeen's celebrated antiquities. There are many public works and buildings, and ringing the outskirts, a series of excellent golf links. The native granite is extensively quarried. Other active industries beside fishing include ship-building, jute, cotton and woolen manufactures; chemicals, soap and food-preserving works; distilling and brewing. Pop. 1931, 167,259.

**ABERDEEN**, a city in northeastern Mississippi, the county seat of Monroe Co. It is situated at the

head of navigation on the Tombigbee River, 150 mi. southeast of Memphis, Tenn.; served by three railroads. Aberdeen is a trade center and shipping market in a lumbering and farming region. Powdered milk and lumber are the local manufactures. Near by are oil and gas fields. Aberdeen was founded in 1834 and incorporated in 1837. Pop. 1920, 4,071; 1930, 3,925.

**ABERDEEN**, a city and the trade center for northeastern South Dakota, the county seat of Brown Co. It is situated 160 mi. northwest of Sioux Falls and is served by four railroads and by bus lines. The city is in a fertile farming region, producing corn, wheat, oats, barley, clover, hay and alfalfa. The chief local manufactures are butter, lumber products, automobile radiators and optical goods. The retail trade in 1929 reached a total of \$13,846,552. It is the seat of the Northern State Teachers College, opened in 1901, which has an enrollment of about 1,000 students. Aberdeen was founded in 1881 and incorporated in 1882. Pop. 1920, 14,537; 1930, 16,465.

**ABERDEEN**, a city and port of entry in Washington, about 47 mi. west of Olympia, situated on Gray's Harbor where Captain Robert Gray landed in 1792. The city is intersected by the Chehalis and the Wishkah rivers and is served by three railways, steamship lines, an airport and Federal highways. Puget Sound is accessible by motor bus. The district is industrial, having natural resources of lumber besides an agricultural output, including dairying and poultry raising, valued at nearly two millions. In 1929 the value of the local manufactures was about \$17,000,000; the retail trade amounted to \$17,964,233. Aberdeen is the southern entrance of the Olympic Peninsula, a scenic and recreational center, and has also several local parks and beaches. Homesteaded in 1859 by Samuel Benn and founded in 1884, the city was incorporated in 1890. Pop. 1920, 15,337; 1930, 21,723.

**ABERDEEN, UNIVERSITY OF**, a coeducational institution, situated at Aberdeen, Scotland, consisting of King's and Marischal colleges, united in 1860. King's College, in Old Aberdeen, was founded in 1494 by Bishop Elphinstone. Marischal was established in 1593 by George Keith, 5th Earl Marischal of Scotland. The present university has five faculties and also departments of Education and Commerce. Divinity and the arts are taught at King's; science, law and medicine at Marischal. The oldest existing portion of King's College is the Chapel, built in 1500. The university is well equipped with laboratories, hospitals, a botanical garden, museums and a library containing 250,000 volumes and 200 noted incunabula. Especially noteworthy is the Rowett Institute of Research in Animal Nutrition, established in 1913 near Bankhead. Associated colleges are the North of Scotland College of Agriculture and Robert Gordon Technical College. In 1929-30 the University of Aberdeen enrolled 1,374 full-time students and had a teaching staff of 158. The chancellor of the University in 1930 was the Rt. Hon. Baron Meston of Agra and Dunnottar; the principal, the Very Rev. Sir George Adam Smith.

**ABERRATION IN OPTICAL SYSTEMS.** In analyzing the performance of an optical system, the object to be imaged is commonly assumed to be composed of a series of discrete luminous points, each of which is considered as the vertex of a conical bundle of light rays incident upon the first surface of the optical system. From the last surface there emerges a corresponding bundle of rays which has been transmitted by the optical system. If all the rays of this emergent bundle pass through a single point, this point is the image of the object point and the image is free from aberration. In general, however, the emergent bundle of rays will not pass through a point, which fact is said to be due to aberration.

It is convenient to give separate names to different aspects of the aberration and to refer to them as distinct aberrations. The aberrations usually considered are longitudinal and lateral **CHROMATIC ABERRATION**, **SPHERICAL ABERRATION**, **COMA**, **ASTIGMATISM**, curvature of field and distortion.

**ABERRATION OF LIGHT**, an apparent change in the direction of a star at different times of the year, first discovered by BRADLEY; also, the failure of light from a point to come to a focus when passing through an optical system comprising **MIRRORS** or **LENSES**. The apparent change in the direction of a star is due to the velocity of the earth in its orbit and to the finite velocity of **LIGHT**, and it is commonly expressed by stating that the earth moves forward a certain distance in the time required for the light to travel the length of the observer's optical system. The effect is a maximum when the motion of the observer is at right angles to the true direction of the star, and is such as to make the star appear to be in advance, in the direction of motion, of its true position by a few seconds (circular measure); it is a minimum when the observer is moving along the direction to the star. As a result of this phenomenon, a star will, in the course of one year, describe a small elliptical path in the skies. For a star in the equatorial plane this ellipse degenerates to a line. The magnitude of the aberration is

$\theta = \frac{v}{V} \sin a$ , where  $\theta$  is the aberration or apparent change in direction,  $v$  the velocity of the earth,  $V$  the velocity of light and  $a$  the angle between the direction in which the observer is moving and the direction to the star. The maximum value for  $\theta$  is 20.45". See also **ABERRATION IN OPTICAL SYSTEMS**. P. I. W.

**ABERYSTWITH**, an important harbor, municipal borough and watering-place in Cardiganshire, Wales, on Cardigan Bay. It is the seat of the University College of Wales, founded 1872 and made a University in 1893. Above the city is the university library with 450,000 volumes and many Welsh manuscripts. In picturesque surroundings are the ruins of a castle built by Stronghow and destroyed by Cromwell in the 17th century. Aberystwith has lead mines and carries on important trades. Pop. 1921, 11,211; 1931, 9,474.

**ABETTOR**, in law, one who aids, assists, or advises in the commission of a crime. If present actually or constructively, and abetting the principal

committing the crime, the latter knowing of the abettor's intent, he is guilty as principal in the second degree. Encouragement, even a gesture, is enough. Mere presence without abetting, although the person mentally approved the crime, and is benefited by it, does not involve him unless he was under a legal duty to prevent it. *See also* ACCESSORY; ACCOMPLICE.

**ABEYANCE**, in law, means remaining in present condition or in "statu quo" until something occurs. For example, the franchise of a corporation (*see* CORPORATION LAW) may be withheld until certain stated acts have been done. In the case of Dartmouth College vs. Wood, Chief Justice Story said, "When the corporation is to be brought into existence by some future acts of the corporator, the franchise remains in abeyance, until such acts are done."

**ABIETIC ACID**, an organic acid ( $C_{20}H_{30}O_2$ ), having a complicated structure. It is the main constituent of ROSIN, and combines with alkalies to form so-called rosin soap, which is a component of many common soaps; and with metals to form so-called resinates, certain of which find use as drying agents in PAINTS and VARNISHES.

**BIBLIOGRAPHY.**—T. H. Barry, A. A. Drummond and R. S. Morrell, *Chemistry of the Natural and Synthetic Resins*.

**ABIGAIL**, a Biblical heroine (I Samuel 25). Her husband, Nabal, was a wealthy landowner in Mount Carmel, but "churlish and evil in his doings." David, as a refugee from Saul, protected Nabal's live stock yet was refused the reward usual under such circumstances. At this defiance David set forth to subject Nabal to the sword but was met by Abigail, "a woman of good understanding and of a beautiful countenance," who offered gifts and made obeisance. So appeased, David departed and Abigail, returning to Nabal, found him "very drunken." Next morning he learned what had happened and "he became as a stone," dying from the shock "about ten days after." Saul had deprived David of his wife Michal and the future king married Abigail who bore him a son, variously called Chileab or Daniel. He did not, however, succeed to the throne, which fell to Solomon. A second Abigail appears as sister of David (II Samuel 17:25).

**ABILENE**, a city in central Kansas, the county seat of Dickinson Co., situated on Smoky Hill River, 95 mi. west of Topeka. Served by three railroads, the city is a shipping market for live stock and grain. Flour mills and a creamery are the chief industrial concerns. There are medicinal mineral springs and bottling works. Abilene is essentially residential. It was settled about 1860, and was the northern terminus of the Texas cattle trail in the early days. It is the scene of some of Emerson Hough's novels. Abilene became a city in 1869. Pop. 1920, 4,895; 1930, 5,685.

**ABILENE**, a city in western central Texas, the county seat and trade center of Taylor Co., situated in a fine hilly country about 160 mi. southwest of Fort Worth. The city is served by three railroads, bus lines and air lines. Cotton and grain sorghum

are the chief crops of the vicinity; clothing, food products and brooms are the local manufacture. In 1929 the value of the factory output was about \$5,000,000; the retail trade in 1929 was valued at \$17,344,536. Near Abilene is the State Hospital for Epileptics. Three colleges, Abilene Christian College, McMurry College and Simmons University, are located in Abilene. The city was founded in 1881 and incorporated in 1882. Pop. 1920, 10,274; 1930, 23,175.

**ABILITY**, the power or capacity to perform given tasks. The term is often applied to mental capacity and in this sense is synonymous with intelligence. Intelligence is innate ability. In a broader meaning ability may include both native capacity and training. In actual performance both factors are involved, and in many cases it is very difficult to say where the one ends and the other begins. Much interest has centered about the term "ability" since efforts to measure intelligence began in the late 19th century. For a time this movement met with but little encouragement, but as the possibility of such an achievement attained recognition the movement spread and has acquired a large following. Nevertheless it seems to be on the wane at the present time. The names of Binet, Spearman, Thorndike and Terman are outstanding among its exponents.

Many types of tests have been constructed in the innumerable attempts to measure ability. Some of these have proved very useful; many of them, on the contrary, have been worthless. There is much disagreement among experts as to exactly what the tests measure. Nevertheless it seems to be generally agreed that these tests are an index to something that has significance. There is evidence, however, that the faith once put in them is vanishing.

An example of some of the difficulties involved in the problem of measuring ability may be cited in the question of the relation between general and special ability. Even when this has been answered satisfactorily, the further question arises as to the possibility of measuring innate capacity. Is intelligence general or is it specific? In some instances there seems to be evidence that it is general, in others that it is much more specific. For instance, one might distinguish between mathematical and mechanical ability, using the one in the sense of ability to manipulate abstract symbols and the other an ability to operate on concrete materials. Do the two necessarily belong together, and are apparent discrepancies due solely to the chance element of training? General ability may also be considered as the average of many specific abilities. This is a different sort of thing, however, from a general intelligence, or an ability that would be equally good at almost anything if it had equal opportunities in various fields.

The problem of measuring innate capacity is intensified by the difficulty of eliminating the experiential element in the procedure. Since the test must be given in experience, it is quite impossible to rule this factor out altogether. Nevertheless we can approximate it, and it is such an approximation that intelli-



gence tests would achieve. It is much easier to construct tests that are an index to ability from the standpoint of performance than to construct those which shall indicate native endowments. The performance tests aim at indexing ability in terms of both capacity and training.

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**ABINGTON**, a town and village in Plymouth Co., eastern Massachusetts, situated 19 mi. southeast of Boston. The village is served by the New Haven Railroad and bus lines. Fruits, especially strawberries, are the principal crops. Abington village has shoelast and window shade factories, cement works and machine shops. The town was founded in 1680. Pop. 1920, 5,787; 1930, 5,872.

**ABIOTENESIS**, a term, the antithesis of biogenesis, used by Huxley (1870) to express the origin of living forms independently of other life. Abiogenesis is synonymous with spontaneous generation. During ancient times, in the Middle Ages and persisting much later, the belief was general that living creatures such as worms and insects arose from stagnant water, mud or decaying flesh quite without parent forms. Despite experimental proof to the contrary (Redi, Spallanzani) the question remained a live one, and as the microscope revealed more and more minute forms of life, i.e., germs, doubts of the universal application of the doctrine—all life from pre-existing life—were continually expressed. The controversy may be considered as settled through the crucial experiments of PASTEUR (1860-78) and of TYNDALL (1881).

To-day the doctrine of biogenesis underlies all medical theory and practice and all procedures in the preservation of foods, and is fundamental in the conception of life. Proof that abiogenesis may not sometimes and somewhere occur cannot of course be forthcoming, and any theory of the first beginnings of life on the earth, archeobiosis, must take account of it.

B. F. K.

**ABKHASIA** or **ABASIA**, a Soviet republic of European Russia, embraced in the Georgian S.S.R., on the heavily wooded southern slope of the Caucasus, covering an area of 3,011 sq. mi. Its boundaries are the North Caucasian Region and the Karachay Autonomous Area to the north, the Georgian Republic to the south and east, and the Black Sea to the west. The summer season is moderately warm, the winters rainy. Agriculture is the major industry; the leading products are maize, tobacco, wheat, fruits and tea. In the higher districts the peasants engage in stockbreeding. The principal town is Sukhum on the East coast of the Black Sea. Est. pop. 1926, 200,000.

**ABLUTION**, any ceremonial cleansing from impurity, physical or spiritual, which is due to contact with the dead, with blood, leprosy, persons of a lower caste, madness or other form of mystical contamination, or to sin in the individual himself. Rites of ablution are varied and world-wide and, in certain cases, are to be distinguished carefully from the hy-

gienic use of soap, as usually understood. For instance the Hindu bathes ceremonially in the Ganges at Benares and in sacred pools which, analyzed by the scientist, are unsanitary. In the worship of the Hebrew Temple ablution was reconciled with the claims of health. Before entering the Holy Place the priest washed in the water of the laver. In the Roman Catholic Church the use of holy water suggests a similar idea, and at the celebration of the Mass ablution, applied to the chalice and priest's fingers, is an important element in the rite. Among Moslems (see ISLAM), each of the five daily acts of worship is preceded by the lesser ablution, namely, a washing of the face and arms up to the elbow, and the feet. Under special necessity the whole body has to be washed and the use of sand is permitted where water is not available. The washing of another's hands and feet has been regarded in the East as a servile task. On two occasions the feet of Jesus were so cleansed by a woman when he was dining, and at the Last Supper he washed the disciples' feet. Out of this precedent there has developed the public ceremony, in Spain and Italy for instance, at which ecclesiastics of high rank, princes and nobles wash the feet of the poor.

**ABNAKI**, an Algonkian Indian confederacy which centered in what is now the State of Maine and included among other tribes the Penobscot, Passamaquoddy and Malecite. The name has been applied also to the Oneida, Stockbridge and Munsee Indians now living near Green Bay, Wis. In the Colonial Wars they were constant allies of the French against the English, after which they gradually withdrew to Canada, the remnants of the group now living near St. Francis, Quebec. They were essentially a hunting and fishing people, but placed some reliance on the cultivation of maize. They lived in birchbark or mat-covered conical houses in palisaded villages. Their social organization was simple, a war and civil chief, and two councils being the ruling forces.

**ABNER**, a Biblical hero. Kish, father of Saul, and Ner, father of Abner, were brothers (I Chronicles 9:36). Abner, therefore, was Saul's first cousin; also general of his army. It was he who led young David, carrying the head of Goliath, into Saul's presence and ever after Abner was to David as a "prince" (I Samuel 17:55-57). Abner sought to maintain the cripple Ishbosheth on the throne, but was alienated by an insult. He played a very dramatic part in the civil war, slaying David's nephew, Asahel, a son of Zeruiah. He was treacherously stabbed "under the fifth rib" by Asahel's masterful brother Joab. David's lament over Abner is lyrical: "as a man falleth before wicked men, so fellest thou."

**ABNORMAL PSYCHOLOGY** comprises the study of the varieties of mental phenomena that depart from the normal condition. Its scope may be conveniently divided into (1) the study of abnormal states, conditions and symptoms; (2) the type forms of deviation; (3) abnormal behavior in general and in its social setting.

**Dreams and Dissociation.** With the standard state, that of alert, waking thought, sleep and dreams become abnormal, though the change of mental state called sleep is indispensable to the rhythm of living. DREAMS are key phenomena of the mental life in that they represent the partial resumption of mental activity, while the rest remain dormant. There emerge two leading concepts: dissociation and the subconscious. Sleep is a natural form of dissociation. Consciousness, sensation, movement go into abeyance; yet the more physiological activities and some form of psychic life continue. An accumulation of phlegm may awaken the sleeper; so may a thunder clap. The cry of her child may awaken a sleeping mother, or the click of his signal a dozing telegraph clerk. There is a "set" of alertness to response, even in sleep. Dreams are thought-sequences, dramatic episodes which may be induced by sensory stimuli. The slipping of the bedcovers may induce a dream of cold or exposure; the sound of a bell, that yet fails to awaken, may suggest a dream of an alarm of fire or a sleigh-bell episode, or the chimes of a church ceremony. Distressing dreams, or nightmares, may have their origin in disturbed breathing; and a dream of falling arise from a change in the sense of support.

Should the sleeper leave his bed and proceed upon some quest (*see* SOMNAMBULISM), the dissociated state would be more marked and unusual, in that locomotion is accomplished, with some selective response to the environment. The somnambulist's behavior is abnormal, a strange dissociation, in the main asleep but in a given directness awake.

Because the nervous system contains the dissociating mechanism of sleep, it is also possible to produce a deeper dissociation by means of such brief anaesthesia as follows a whiff of nitrous oxide gas, or the prolonged surgical anaesthesia of ether. The higher centers may be in abeyance while the intermediate and the lower ones function. In coming out of the ether, as in breaking a trance, the resumption of waking functions may be observed. Other drugs, such as opium, hasheesh, mescal and alcohol, invade the nervous system differently and bring about distortions of sense impressions, delusions, motor impairment, release of inhibitions, flighty ideas. TRANCE states present still different patterns of dissociation, according to which of the normal powers are retained, which lost, which distorted; while states of abstraction or absent-mindedness are miniature phenomena of the same order.

The SUBCONSCIOUS aspect of these states appears in the sensory stimuli of dreams, in the continuation in dreaming of depressions and worries and concerns of waking life, and still more clearly in the fantasies of day-dreaming which supply a rich undercurrent, somewhat submerged in the alert occupations of conscious thought, and rising to expression when the directive centers are in abeyance. Delirium and similar stages of partial excitement illustrate as well dissociation and assertiveness of subconscious, or partly repressed, emotional and intellectual occupations. In such arti-

ficially induced conditions as hypnosis (*see* HYPNOTISM), the functions retained and those lost are under control by direct suggestion from the outside, and the relation of subconscious factors may be investigated.

**Type Forms of Deviation.** With these illustrations of the variety of symptoms that occur in abnormal conditions, we may proceed to the personal aspects of the abnormal, as they appear dominantly in the neuroses and the liabilities to them, which may be considered as deviations in pattern types of behavior. The nearer to normal deviations are functional in that they arise from no organic defect, but from disturbance in the working of the several neural mechanisms or from their disharmony. Characteristic are hysteria and neurasthenia.

Hysteria when pronounced becomes a nervous disorder which may be regarded as the end stages of a temperamental liability. Its symptoms are various and changeable. Central is an emotional over-excitability, characteristically that of an anger explosion, as in the tantrums of childhood in simplest pattern, yet a liability equally apparent in panicky fears, in excessive sentimentality, erotic passion or Puritan conscientiousness. Wayward impulses and outbreaks, such as a kleptomaniac episode, a paroxysm of despair, a religious ecstasy, frantic excitement, shouting and jumping, uncontrollable tears and laughter, all conform to the hysterical pattern, which is evident likewise in financial hysteria, war hysteria, mob hysteria, and more innocently in football or hero worship enthusiasm. The hysterical temperament is prone to large and rapid oscillations, as appears in the intensities of childish and adolescent response, and in so far inclines to instability.

The pervasive influence of sex emotion, aiding and abetting the personalized reaction to all social situations, directs the hysterical stresses. The hysterical bid for attention and notoriety, the letting go in an abandon of expression, adds to the picture, while yet, as the Freudian analysis emphasizes, the very repression of restraint adds to the pressure which geyser-like accumulates and breaks forth. All the vital emotions, deep-set in dominant urges, are liable to hysterical exaggeration and waywardness of expression.

The second focus of hysterical response is the tendency to dissociation. This is generally recognized in the hysterical nature of trance-states, in somnambulism, in oracles and mediums, in automatic writing, in religious frenzy and ecstasy, in the association of hysteria with hypnosis, in the origin of dual personalities. It may be summed up in a disposition to lapse which is apparent even in absent-mindedness. How the two orders of symptoms are connected is not wholly clear; an emotional instability underlies both.

In pronounced hysteria as a neurotic disorder the two may combine. There may be convulsive attacks, hysterical stupor, frantic outbreaks of violence. Characteristic are the losses or impairments of sensation, or anaesthesia, and of motor systems, or paralyses, which were made familiar by shell shock cases, of soldiers blind or deaf, paralyzed or overcome by



tremors, or in losses of consciousness and irresponsible states. The mimicry of all varieties of bodily ailments, which when without organic source, are called hysterical, demonstrate the mechanism; and no less the sudden cure or relief, when crutches are cast aside at shrines, and the bedridden walk under moments of excitement. The impairment is of hysterical depth and the cure likewise.

The Freudian analysis began with hysterical cases and added the consideration that the symptoms are induced by subconscious intrusions, typically associated with desires or repressions of sex. What appears as a loss of sensation or motion is a substitute symptom of psychic origin, expressed as a bodily incapacity. Hysteria remains a generic clue to a great variety of abnormalities in disposition and behavior; these, when developed, may take the form of a characteristic neurosis.

The second division of the functional neuroses is neurasthenia, whose key symptom is an undue sensitiveness to fatigue. Its central emotion is fear which develops an inhibited, apprehensive, incapacitating, anxious, depressed state. As the hysterical condition leads to over-activity, so the neurasthenic liability prostrates. With it are associated bodily pains and general distresses, feelings of inadequacy and impending disaster. The large group of phobias, which may crystallize about specific situations, such as fear of open spaces and loss of freedom, are typically neurasthenic. When these develop and are systematized and elaborated into obsessions and incapacities to face ordinary situations, they approach the psychasthenic variety. The neurasthenic is the typically introverted, self-inhibited personality, full of tensions and anxieties. His symptoms, though subjective, are intensely real, and their control is difficult to establish, by reason of the enfeebled will. It is in cases of so-called nervous breakdown that neurasthenia reaches its acute expression.

**Applications.** The two orders of neurotic liability have something in common despite their contrasts. They suggest patterns of PERSONALITY and illustrate the principle of abnormal psychology that the normal contains the core of the abnormal in miniature, and the abnormal is but the normal in exaggeration. The social phases of abnormal psychology are far-reaching. Mental defect enters into the problems of delinquency and crime. It represents a limitation of development. The imbecile remains permanently at the mental level of a three to seven year old child, the idiot still lower; while the feeble-minded extend from the moron, with a ten to twelve year old mentality, through the subnormal range. The incapacity to mature beyond a fixed level and the insistent urges, the sex urge notably, together with insufficient capacity for control, indicate how markedly social adjustment proceeds upon an understanding of abnormal psychology. The same applies to problem children, in whom again appear at their own level the sources of maladjustment and character deficits that may develop to neuroses or become a social menace.

The early signs of nervous instability need careful attention; conflict and environmental situations bear the seeds of misconduct. The formation of character is a psychological, no less than a moral, problem. Lying, stealing, cheating, resentment, cruelty, aloofness, truancy, wilfulness, vagrancy, sex-offenses, destructiveness, too great dependence, fixations, morbid brooding, day-dreaming, all become symptoms in the educational process of wholesome growth and adjustment. These are characteristic of the adolescent unrest. (*See ADOLESCENCE*). Types of abnormality emerge; they extend from lighter forms of deviation to the psychopathic personalities, who now and then break out in some outrageous crime. The psychopathic contingent in the ranks of the fanatic, the erotic, the queer or the anti-social is a large one.

**Clinical Psychology.** Clinical psychology has developed because of the widespread recognition of minor mental maladjustment. The stresses and strains of modern life have brought about upsetting tensions and psychic assault. The consequence is a vast increase of minor and major mental disorder; for the abnormal issue is ever a double one: a tendency to succumb on the one hand, the wear and tear of life on the other. Of the original limitation, feeble-mindedness, as indicated, represents a limited capacity and an early arrest. The mental disorder known as *dementia praecox* represents another common liability to rapid deterioration once the adult stage is approached or reached. Though there are delayed cases, the disorder occurs typically on an hereditary limitation manifest in youth. The manic depressive psychoses form another large group of recurrent tendencies that for a time incapacitate and disclose an instability; while the dissolutions of old age present end stages of loss and distortion.

This field of PSYCHIATRY is interpreted largely in psychological terms. Systems of delusions, failures of orientation, dazed and confused states, regression to childish reactions, afford a clue to the abnormal behavior. While paranoia as a definite mental disorder is uncommon, the paranoiac has his counterpart in the fanatical or eccentric personality, who may still be able to adjust his behavior to the ordinary world. The irresponsibility under an acute alcoholic invasion presents symptoms comparable to states of excitement and deterioration. Thus the study of mental disorder is profoundly affected by the illumination of symptoms as reflected in abnormal behavior generally, much of it exhibited by persons in most respects normal.

**The Freudian Contribution.** The Freudian psychology attempts a comprehensive formulation to include normal and abnormal alike. The psychogenic mechanism by which an emotional disturbance induces a bodily incapacity appears in the above cited case of paralysis in left hand. The illustration shows also the subconscious source, and the radiation of the sex motive. The typical concept of explanation becomes the COMPLEX which arises by FIXATION in the wayward course of development. A neurosis thus appears as a conflict referred by Freud to episodes or

tensions in the parent child relation; according to this view early shocks induce later neuroses. Yet it may be that the disposition to react intensively and abnormally to upsetting experiences of childhood again asserts itself in the neurotic liabilities of a later period. The libido of desire, to Freud, always with a sexual tone, becomes hampered or frustrated in its expression. Out of such repressed desires and thwarted urges, arise conflict situations.

The technique of **PSYCHOANALYSIS** attempts to bring these to expression by release, lifting them from the subconscious to the conscious state. The neurosis is regarded as an escape into illness to avoid unpleasant situations; while day-dreaming as well as night dreams, delusions and fantasies are avenues of compensation. The Freudian analysis, based on abnormal phenomena, becomes a clue to character deficits and types of personality in the normal field as well. It is applied to explanations of myths and fairy-tales, to cultural taboos and ceremonial rites and customs. In the hands of Jung the urge to power and self-expression becomes the dominant clue, with sex as a central relation, while in Adler this libido is still further generalized into a striving for a goal, in which the inadequacies in the competitive struggle develop an inferiority feeling.

Whatever the measure of truth in this version, the Freudian contribution to abnormal psychology is a notable one. It affords a psychological clue to the minor neuroses, to many symptoms in the major disorders, and to a clinical understanding of the components of character and the formative influence of personal and social relations.

**Organic Clues and Mental Hygiene.** Recent knowledge has equally reenforced the physiological determination of mental abnormalities, particularly by demonstrating the wide and subtle influence of the glands. That thyroid deficiency is responsible for certain forms of mental defect has been made clear; feeble-minded cretins have been made nearly normal by administering thyroid extract. The pituitary gland is associated with the regulations of growth. The profound changes of adolescence function by way of the sex glands. It is clear that a glandular balance plays a part in psychic normality and in the disturbances of abnormality.

From all these sources combined have arisen new insights into the nature of human behavior and the conditions of its normal expression. The movement for **MENTAL HYGIENE** has resulted from this recognition. Thus abnormal psychology has taken its place not only as an important division of the mental domain but as a body of principles to be applied in the interpretation of personality, in the direction of educative processes, in the provisions for public welfare and the ministrations in the interests of reducing delinquency, crime and mental maladjustment. J. J.

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**ABO.** See **TURKU**.

**ABODE**, one's fixed place of residence. The court in a Pennsylvania case said, "How a place could be made a place of abode without personal residence is difficult to imagine." In some states the word for abode as used in law refers particularly to where a voter lives. In an Illinois case, the judge held, "A permanent abode is necessary to constitute a residence, within the meaning of that word in election laws."

**ABOLITIONISTS**, the uncompromising opponents of slavery in the United States, a vigorously assertive minority group from 1831, the date of the first appearance of William Lloyd Garrison's *Liberator*, to the issuance of the **EMANCIPATION PROCLAMATION**. They advocated immediate abolition of slavery, regardless of expedience, and generally refused to recognize as binding any fundamental law or statute which countenanced slavery. Garrison, Wendell Phillips, Arthur Tappan, Theodore Parker and John Brown were leading abolitionists. The prominent antislavery statesmen were not abolitionists, properly speaking; but in 1856 the movement invaded national politics, a Political Abolitionist convention nominating Gerrit Smith for president and Frederick Douglass for vice-president. The vote was insignificant.

**ABOMINATIONS, TARIFF OF**, the tariff act of 1828, derogatively characterized by southerners. The tariff, largely increasing the duties on woolens, iron, flax, hemp and other articles, introduced the principle of high protection of the raw materials used in American manufactures, and carried the principle of protection to its greatest extreme before the Civil War. The predominantly agricultural South, whose interests lay in free trade with England, its principal customer for cotton and tobacco, manifested bitter opposition to the protective policy.

**ABORTION**, the expulsion of the fetus from the pregnant uterus before it is viable. Abortion may be due to accident, to abnormal formation of the generative organs, to disease or to infection. It may also be brought about by the surgeon when necessary for therapeutic reasons, but when induced unnecessarily it is known as criminal abortion. Abortion is generally known as "miscarriage," especially when occurring in the first months of pregnancy. When the fetus is viable but born in the eighth month of pregnancy, it is known as premature labor or delivery.

**Legal Aspects of Abortion.** Abortion is a crime in the United States except in some states, and in most other countries. When done in the first three months after conception it is usually considered only a misdemeanor. At common law, as well as by statutes, it is unlawful to use any noxious drugs through which the result may be obtained. Noxious drugs, in this sense, not only include poisons, but comprise any drug used in sufficient quantities to produce miscarriage.

**ABOUKIR**, the ancient Canopus, a village of Egypt on the Mediterranean, 10 mi. east of Alexandria. Three important battles have taken place in

and near the bay of Aboukir: in 1798 the British under Nelson defeated a French fleet and completely destroyed the naval power of France in the Mediterranean. In the following year Napoleon defeated the Turks under Mustapha, and in 1801 after severe fighting against the French, Abercromby effected the landing of a British army.

**ABOUT, EDMOND FRANÇOIS VALENTIN** (1828-85), French novelist and journalist, was born at Dieuze, Feb. 14, 1828. He studied at Paris and at the French school in Athens, Greece. In 1853 he returned to Paris and wrote *la Grèce contemporaine* and *Tolla. Le Roi des montagnes*, a novel in which About's gift for irony finds rich expression, followed in 1856. Turning to journalism, About ardently supported the Second Empire until its fall in 1870. Two years later he founded, with Francisque Sarcey, *le XIX<sup>e</sup> siècle*, a journal which had great influence in its time. About was elected to the French Academy in 1884, but died before his official inception. His death occurred at Paris, Jan. 17, 1885. Among his other works are *les Mariages de Paris* and *Madelon*.

**ABRACADABRA**, a word apparently derived from the Hebrew *Ab*, Father, *Ben*, Son, and *Ruach Acadosch*, Holy Spirit. The Gnostics (see Gnosticism) used it as a cabalistic charm, similar to the word Abraxas, the letters of which in Greek numerals make up 365, the number of orders supposed to proceed from the Supreme Being. In modern usage Abracadabra means any incomprehensible formula and is applied by ignorance to theories not easy to understand.

**ABRAHAM** or **ABRAM**, greatest of patriarchs and founder of the Hebrew people. His father was TERAH, and there were three brothers, Abram, Nahor and Haran. The wife of Abram was Sarai (see SARAH) who was childless. Nahor was grandfather of REBEKAH, and Haran's son and Abram's nephew was LOT. The family decided to emigrate from the elaborate but cruel civilization of Ur of the Chaldees, or Mesopotamia. Avoiding the Arabian desert, they made their way by Haran, where Terah died, to Damascus. Thence they proceeded into Palestine where Abram built an altar at Bethel. Famine drove Abram into Egypt, and on returning to Palestine, Lot separated from Abram and made his home in Sodom.

In a vision of profound solemnity, Abram was assured by God that a nation would honor him as ancestor. Sarai, still being childless, gave her handmaiden Hagar to Abram, and Ishmael was born. A further revelation changed the name Abram, meaning father of elevation, to Abraham, or father of a multitude, and Sarai, my princess, became Sarah, princess, without restriction. At length there was born to Sarah a son, ISAAC. Following the custom of history, Abraham had other wives. At the age of 175 years he died, being buried in the Cave of Machpelar, which is still revered as his tomb. Abraham dwelt in a tent; but the idea that he was merely what to-day is known as a Bedouin sheik, is wholly inadequate to his real prestige. He was highly educated, spiritual and wealthy, not a barbarian but a pioneer,

who applied his culture to life in "a strange country," less developed, but more wholesome than that to which he had been accustomed. In this sense, he was the first of the pilgrim fathers who (Hebrews 11:8) "went out, not knowing whither he went," and, a leader of ineffaceable dignity, settled in "a land of promise."

**ABRAHAM IBN DAUD** (c. 1110-80), generally called Rabad I, Jewish astronomer, philosopher of religion and historian, was born at Toledo, Spain, about 1110. He died a martyr's death about 1180 in an anti-Jewish riot. His philosophical writings profoundly influenced MOSES MAIMONIDES.

In his great historical work, *Seder Haqabbalah*, or *The Order of Tradition*, 1161, written in Hebrew, Ibn Daud presented a chronological survey of Jewish tradition. As a philosopher he was the first consistent Jewish Aristotelian of the Middle Ages. His main work in this field was his Arabic *Al-Akidah al-Rafiyah*, which was translated into Hebrew by Solomon ben Labi under the title of *Emunah Ramah*, The Sublime Faith.

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**ABRAHAM IBN EZRA.** See IBN EZRA, ABRAHAM.

**ABRASION TESTS.** See ROCK TESTS; BRICK TESTS; CONCRETE TESTS.

**ABRASIVES**, commercial, are corundum, carborundum, crystolon, alundum and aloxite, although a multitude of abrasives are sold under many trade names. Corundum is a natural oxide of aluminum, which varies in quality according to the locality in which it is found. Carborundum and crystolon are SILICON CARBIDE, a product of the electric furnace. Alundum and aloxite are also artificial, being fused oxide of aluminum. The artificial abrasives are durable, being more uniform in quality and break with a sharper cutting edge. For coating cloth or paper, quartz, glass and garnets are also used as abrasives, being commonly known as SAND PAPER.

There are two important factors in abrasive wheels, the grit or cutting materials, and the "bond" by which the abrasives are held together. The toughness, character of the fracture, and size of the grit determine its cutting qualities, while the bond gives the wheel strength to resist the stresses of high speeds and of cutting, and determines its hardness—a "soft" bond permitting the particles of abrasives to be torn out easily, thus presenting new cutting particles to the work, while a "hard" bond holds the particles until they become too dull to cut and the wheel "glazes." Both the size of the grit and the character of the bond are highly important.

There are four types of bonds in general use, vitrified, silicate, elastic and rubber. The *vitrified* bond is made of fused clay, and is capable of a great range of hardness; it has no elasticity but is widely used in many types of grinding wheels. The *silicate* bond is

made of clays fluxed by silicate of soda at low temperatures; it is not as widely used as the vitrified bond and has no elasticity. Shellac and other gums are used in the *elastic* bond, which has a high tensile strength and can be used in making very thin wheels for "cutting off" and similar work. *Rubber* or *vulcanite* bonds are similar to the elastic bonds, but their hardness cannot be varied to the same extent and their uses are limited.

Abrasives are crushed and sorted according to the size of the grain. A No. 20 grain will pass through a sieve having 20 openings to the linear inch. Grains as fine as No. 200 can be obtained, and some abrasive powders are even finer. Pulverized diamonds, or diamond dust made from "black diamond" or bort, are also used as an abrasive in fine LAPPING.

F. H. C.

**ABRAVANEL, ISAAC** (1437-1508), Jewish statesman, philosopher, commentator on the Bible, and apologist for Judaism, was born at Lisbon, Portugal, in 1437. He was a prominent member of the Abravanel family of Spain. A man of unusual political abilities, he became the trusted treasurer of King Alfonso V of Portugal at an early age, an office he held for many years. When John II, the successor of Alfonso, falsely accused Abravanel of conspiracy, he fled to Castile in 1483, settling at Toledo. In 1492, when Ferdinand and Isabella decreed the expulsion of all the Jews from Spain, Abravanel made several unsuccessful attempts to have the edict revoked. Not even the great sums of money which he offered were of any avail. That same year he left Spain and settled in Naples, later in other Italian cities, finally in Venice, where he again entered the royal diplomatic service as treaty maker. He died in Venice in 1508.

Abravanel is renowned for his literary achievements. As an exegete he wrote a commentary on all the books of the Old Testament except the Hagiographa.

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**ABRAXAS**, a cabalistic word similar to ABRACADABRA.

**ABROGATION**, the termination of TREATIES between sovereign states. This is accomplished through the consent of the parties when the terms of continuance no longer exist; when either party refuses to perform a material stipulation; when all material stipulations have been performed; when a party having the option to do so elects to withdraw; when performance becomes physically or morally impossible; and when a state of things which was the basis of the treaty, and one of its tacit conditions no longer exists. Under American constitutional law, a treaty may be expressly abrogated by act of Congress, or by a later treaty, either because of inconsistent provisions of the former treaty, or because of express stipulations of the later one. Under the doctrine of *Rebus Sic Stantibus*, a treaty may be regarded as abrogated when the material circumstances upon which it rests change.

**ABRUZZI, DUKE OF THE** (1873- ), Italian Arctic explorer and vice-admiral, born in Madrid, Spain, Jan. 29, 1873. He was a son of the former Spanish king, Amadeus, Duke of Savoy-Aosta, and was named Luigi Amadeo. During the World War he was commander-in-chief of the Italian naval forces in the Adriatic. He won international note by his explorations and mountain climbing, first attracting attention when he made the first ascent of Mt. St. Elias in Alaska in 1897. He conducted a voyage to Arctic regions in 1899, and part of his party got as far as 86° 33' N. lat., the most northern point reached to that time. He broke another record in 1909 when he ascended 24,600 ft. up Mt. Austen in India.

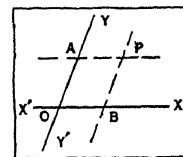
**ABSALOM AND ACHITOPHEL**, a brilliant poetical satire by JOHN DRYDEN, upholding Charles II against the Whigs; published 1681. Based on the Biblical characters, Absalom represents Charles's illegitimate son, the Duke of Monmouth; Achitophel stands for the treacherous Earl of Shaftesbury; and David represents the king.

**ABSCCESS**, a collection of pus in any tissue of the body. In most instances, the pus is circumscribed by a well-defined capsule, though it may be diffuse.

When infection occurs in any tissue in the body, the small blood vessels become swollen. Thus enlarged, they are permeable to the fluid elements of the blood and even to the white blood cells, so that the region becomes engorged with serum and white cells or leucocytes. The leucocytes attack the organisms causing the infection, and some of the tissue in which the infection is located is destroyed and disintegrated.

The resulting space is then filled with a thick liquid made up of leucocytes, dead bacteria, sometimes a few live bacteria, and dead tissue cells. This fluid is called pus, and the collection of pus in the tissue constitutes an abscess. When all the pus is discharged or removed, healing takes place. If the abscess is not drained by cutting into it, the pus will discharge in the direction of least resistance. For example, an abscess near the surface of the skin will drain toward the surface, but a deep abscess not properly drained may infiltrate some vital tissue or organ. *See also* INFLAMMATION; INFECTION; PATHOLOGY.

**ABSCISSA**, in analytic geometry, the distance *AP* (or *OB*) of a point *P* from the axis of ordinates, *OY*, measured along a line parallel to the axis of abscissas, *OX*. *See* COORDINATES; ANALYTIC GEOMETRY; AXIS.



ABSCISSA OF POINT  
P IS AP

**ABSCOND**, in law, means secretly leaving the state for unlawful reasons. An exception occurs in a Maryland case, where a court held that a party may abscond and subject himself to the liability of absconding debtors and still not depart from the limits of the state. Mere absence is not absconding and one openly leaving the state is not considered an absconder. A Michigan court holds

that absconding, in the eye of the law, means something more than a temporary absence for health. It involves a clandestine design to conceal oneself for the purpose of avoiding legal proceedings.

**ABSENT VOTING**, legal provision for the casting of an electoral ballot by a qualified voter absent from his place of residence. In Sweden a soldier's wife may cast his vote in a sealed envelope, and a husband a wife's vote. Similar privileges are accorded absent seamen, railway and other employees who may vote by mail. Absent voting is also legalized in Norway, New Zealand, Australia, in certain Swiss CANTONS, and in at least 18 of the states of the United States.

**ABSINTHE**. See WORMWOOD.

**ABSOLUTE**, a philosophical term used in opposition to the term relative; the ground principle of the universe. A truth that is absolute is not relative; i.e., it is not dependent on conditions and circumstances. If it is true at all it is always true. That two plus two equal four is as true at one time or circumstance as at another. Mathematics is thus the closest approach to absolute truth.

In its other meaning the absolute has reference to the ultimate nature of things. What is the underlying principle of the universe? Some sort of an absolute has been a favorite answer to this question. The absolute may take the form of a spiritual reality, as with the Romanticists, or an impersonal substance, as with BARUCH SPINOZA. In either manifestation it is the unconditioned and unlimited, the perfected and completed, that which embodies all possible relations within itself but which is not related to any other thing.

The absolute made its first appearance in ANAXIMANDER's conception of the unlimited. ARISTOTLE took the theory up and gave it much importance in his idea of the first mover, or the uncaused cause of things. The doctrine of the absolute reached its height in the philosophy of GEORG WILHELM FRIEDRICH HEGEL. Josiah Royce in the United States, and Francis H. Bradley in England, have been recent exponents of the absolute.

**ABSOLUTE MAGNITUDE**, the brightness under which a star would appear if it were placed at the standard distance of ten PARSECS from us.

**ABSOLUTE MUSIC**, the name for music that does not portray external events or imitate the sounds of nature, such as the splash of waterfalls, the song of birds, or the gallop of horses. In broad terms, it is any composition that neither tells a story nor paints a picture. A few symphonies, such as BEETHOVEN's *Pastoral Symphony*, belong to an opposite class of compositions called PROGRAM MUSIC; but the majority of instrumental works by composers of the classical and romantic periods are non-descriptive in effect and by intention.

**ABSOLUTE PITCH**, in music, has two meanings. 1. Among singers it refers to the ability to name any isolated tone upon merely hearing it, or to sing any tone that may be called for by name, giving it

its proper pitch without assistance from an instrument. Relatively few musicians possess this faculty. Theoretically, absolute pitch in a singer is based upon the memory of the performer who places his vocal organs in the position they were in when he produced a tone having the same pitch as some instrument. Inasmuch as standards of tuning have varied throughout the centuries, absolute *relative* pitch would be a more accurate name for the faculty mentioned. 2. As the alternate name of philosophical pitch, it refers to pitch determined by mathematics. Taking one vibration per second as the simplest possible standard to start from, the octave higher is reached by doubling this, continuing to ascend by an octave with each doubling since the octave above any given tone is produced by twice as many vibrations as its lower counterpart. Accordingly starting with 1 and doubling each time, the series are 1, 2, 4, 8, 16 and so on. After ascending eight octaves a point of 256 vibrations per second is reached. Middle C, a tone symbolized by the first leger line below the staff in the treble clef, is taken to be a tone produced by these 256 vibrations per second, and its pitch, determined in the foregoing manner, is termed absolute or philosophical to distinguish it from CONCERT PITCH, which is both variable and arbitrarily determined.

**ABSOLUTE TEMPERATURE SCALE**. As early as 1854, LORD KELVIN pointed out that for scientific purposes what is needed is an *absolute scale* of temperatures, i.e., one which is defined without reference to the behavior of any particular material or substance. The definition of this absolute scale which Lord Kelvin proposed is stated in the highly abstract terms of theoretical THERMODYNAMICS, and it is based on CARNOT's REVERSIBLE CYCLE.

When an ideal thermodynamic engine operates in a reversible cycle between two temperatures,  $T_1$  and  $T_2$ , a certain amount of heat is taken from the source at the higher temperature,  $T_1$ , and a smaller amount is given up to the refrigerator at the lower temperature,  $T_2$ . The difference between these two amounts of heat represents the mechanical work done. The work done by the engine is entirely independent of the material used as the working substance and depends only upon the temperatures. Hence, an absolute temperature scale, in which the degrees are the same size throughout and which is independent of the properties of any particular substance, can be defined as one in which  $T_1$  is one degree higher than  $T_2$  if the amount of work done by the ideal engine working between these temperatures is 1/100 of the amount of work done when it operates between the steam-point and the ice-point.

Kelvin showed that a thermometer using an ideal or perfect GAS as the thermometric substance would give readings on this scale. A perfect gas obeys CHARLES' Law exactly. Its pressure decreases by 1/273.10 of its pressure at the ice-point for a decrease of 1° as just defined. That is, at 273.10° below the ice-point, the pressure would be zero. According to the KINETIC THEORY, this implies that all motion of the mole-

cules has ceased. That is, the gas has given up all of its heat and cannot become any colder. Hence this temperature,  $273.10^{\circ}\text{C}$ . below the ice-point, is properly called *absolute zero*. On the absolute scale, therefore, the ice-point is  $273.10^{\circ}$  and the steam point is  $373.10^{\circ}$ .

A temperature scale defined in this abstract fashion would be of little value if it could not be connected in some way with the indications of an actual instrument. The famous porous-plug experiment, by which the JOULE-THOMSON EFFECT was measured, furnished the data by which the indications of the standard hydrogen or nitrogen gas thermometers are corrected to reduce them to the absolute scale. Mercury thermometers, resistance thermometers, thermoelectric pyrometers and other temperature-measuring devices can be compared directly with the standard gas thermometer. Thus, with actual instruments it is possible to measure temperatures on a scale which could be reproduced exactly even though all the temperature-measuring devices in the world were destroyed simultaneously. Usually, the corrections to be applied to temperature differences, as read by a good mercury thermometer, to reduce the results to the absolute scale are so small as to be negligible, except in work of the highest precision.

As already noted, absolute zero is  $273.10$  centigrade degrees below the ice-point. This corresponds to  $491.58$  Fahrenheit degrees below the ice-point or  $459.58^{\circ}$  below zero Fahrenheit. This temperature has never been reached experimentally, although in the low-temperature laboratory at the University of Leyden temperatures within a few tenths of a degree of it have been attained.

For most calculations, absolute zero is taken as  $-273^{\circ}\text{C}$ . or  $-459.6^{\circ}\text{F}$ ., and centigrade and Fahrenheit temperatures are reduced to absolute temperatures by adding  $273$  or  $459.6$  respectively to the thermometer readings. Absolute temperatures are usually denoted by the letters  $A$  or  $K$ , for Kelvin, if the centigrade scale is used. Temperatures on the absolute Fahrenheit, or Rankine, scale are sometimes indicated by  $R'$ . Thus, the boiling temperature of water under standard atmospheric pressure is  $373^{\circ}\text{A}$ ,  $373^{\circ}\text{K}$  or  $671.6^{\circ}\text{R}'$ . See also CENTIGRADE TEMPERATURE SCALE; FAHRENHEIT TEMPERATURE SCALE; THERMOMETRY.

W. W. S.

**ABSOLUTE VALUE**, the value of a number or quantity irrespective of its sign. Symbolically it is expressed by symbols like  $|-2| = |2|$ . The absolute value of the complex number  $a + bi$  is defined as  $\sqrt{a^2 + b^2}$ , this being the distance from the origin to the point  $(a, bi)$ . See COMPLEX NUMBERS.

**ABSOLUTION**, a release from guilt whether secular or spiritual, pronounced for the benefit of the offender by a competent authority. According to the tradition of the Catholic Church, Eastern and Roman, this responsibility is vested by Scripture in the Church and her ministers, John 20:23: "Whosoever sins ye remit, they are remitted unto them; and whosoever sins ye retain, they are retained." Absolution

follows CONFESSION by the penitent and for many centuries was expressed as a prayer, "May the Lord absolve thee," which form is retained by the Greek Church. But the Latin formula, confirmed by the Council of Trent, is *Ego te absolvo*, "I absolve thee," thus endowing the priest with a judicial prerogative. In the Anglican Prayer Book this form still appears in the Visitation of the Sick, but it is not used in the United States or Ireland. The Absolution in the Communion service is a prayer only: "Almighty God pardon and deliver you from all your sins." At Morning and Evening Prayer, it is stated that the Almighty "hath given power and commandment to His ministers to pronounce to His people, being penitent, the absolution and remission of their sins," but the form continues, "He pardoneth and absolveth," so avoiding the first person singular, characteristic of the Roman rite. In most of the non-episcopal churches of Protestantism there is no ceremonial absolution.

**ABSOLUTISM**, a political concept which affirms the absolute right of the ruler to govern a community, not restrained by legal limitation, moral concepts, or indeed by the so-called laws of nature. Law is the command of the sovereign, carrying authority not by virtue of its content but by virtue of its source. The theory is applicable to all Governments—democracies, oligarchies and monarchies. Its proponents have for the most part, however, been monarchists; nevertheless JEAN-JACQUES ROUSSEAU accepted the concept and made it an integral part of his democratic philosophy.

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**ABSORPTION OF LIGHT**, the taking up of transmitted LIGHT rays by media through which they pass. When light falls upon a body, it may be reflected, transmitted or absorbed. The portion which is absorbed will, in general, cause an increase in the temperature of the absorbing body. It may also be stored, in whole or in part, as potential energy in the ATOMS or MOLECULES, which energy may later be released either as an increase in temperature or as a new RADIATION. The most useful law governing the phenomenon is that absorption is proportional to intensity. The intensity at any depth is then given by the formula,  $I = I_0 e^{-ax}$ , in which  $I_0$  is the original intensity,  $I$  the intensity after passage through a thickness  $x$ ,  $a$  the coefficient of absorption and  $e$  is the Napierian logarithmic base.

Bodies differ greatly in their absorptivity. Some bodies which show large absorption in certain parts of the spectrum (see ABSORPTION SPECTRA) may show very little in other parts; from such variation the term selective absorption arises. The colors of most natural objects result from absorption; the light penetrates their surfaces, suffers internal REFLECTION or REFRACTION and emerges robbed of the rays which are absorbed. A white body is one which reflects light of all WAVE LENGTHS equally well; the best absorbers are black bodies. The ideal black body would absorb all radiation falling upon it, of whatever wave length. The general proposition may be made that good ab-



sorbers are good radiators, the coefficient of absorption being strictly proportional to the coefficient of emission or radiation. *See also* BLACK BODY RADIATION.

P. I. W.

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**ABSORPTION SPECTRA.** Whenever LIGHT passes through any substance or is reflected (*see* REFLECTION) at any surface, it loses a portion of its intensity by absorption. The degree of absorption (*see* ABSORPTION OF LIGHT) depends both on the illuminated substance and on the COLOR of the incident light. If the incident light is white, the different component colors will be absorbed to different degrees, and, hence, the illuminated substance will appear colored on account of the predominance of the remaining colors in the transmitted or reflected light. It is this selective absorption that is the principal origin of color. Red glass appears red because it transmits principally the red portion of light which passes into it, absorbing the other colors. Foliage reflects principally the green portion of sunlight, absorbing the other colors.

If white light passes through, or is reflected by, a colored substance and then spread out into a spectrum (*see* LINE SPECTRUM), the colors lost by absorption naturally will not be present. Consequently, dark bands in the spectrum will exist in the regions where the absorbed colors otherwise would have been found. These are termed absorption bands, and an EMISSION SPECTRUM containing such bands becomes, thereby, an absorption spectrum.

Absorption bands produced by liquids and solids are usually very broad, sometimes covering the larger portion of the visible spectrum. This property of solutions is utilized extensively in the preparation of light filters (*see* FILTERS, LIGHT). Many such filters are now procurable. By a discriminating choice, they may be so combined as to isolate or subordinate almost any desired region of the spectrum. Gelatin films, or even glass plates, may be impregnated with such solutions. A very common example of the use of such a filter is to be found in the blue glass of the so-called daylight incandescent lamp. This glass absorbs the excess of red and yellow light given off from the incandescent filament of the lamp, thereby producing the balance between the colors of the spectrum which is characteristic of white light.

Absorption bands produced by gases and vapors are, unlike those of liquids and solids, very narrow; so narrow that they appear as sharp dark lines across the spectrum. The best example of a line type of absorption spectrum is the solar spectrum.

When the absorption spectrum of an incandescent gas is compared with the emission spectrum of the same gas, it is found that for every dark line of the absorption spectrum there is a corresponding bright line of the emission spectrum. The converse is not true, there being certain types of emission lines for which corresponding absorption lines are not readily observed. This difference between absorption and emission spectra forms one basis for a well known

theory of the origin of spectra, viz., the QUANTUM THEORY.

L. W. T.

**ABSORPTION TESTS** are made on CONCRETE, concrete AGGREGATES, building brick, sewer brick, building stone, clay pipes, concrete pipe, wood, slate, etc. Ability to resist absorption of water is desirable where materials may be subject to wetting and drying, or freezing and thawing.

The material is first brought to a constant weight by heating at a temperature around 100-110° C. It is then immersed in water at a designated temperature for a time varying from five hours to two weeks. Surface moisture is removed, and the final weight determined. Methods of testing are generally those prescribed by the American Society for Testing Materials.

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**ABSTRACTION**, the drawing-out process involved in thinking. Any problem contains elements not all equally well understood. These doubtful factors must be taken up from the rest and worked over by thought so that the thinker may see what they mean and promise. This process is one of abstraction. Concepts are taken out of their original setting and considered by themselves. New meanings are thus derived by abstraction. To abstract is to take a thing out of its present situation in order to see what meaning it may have in other situations. The Socratic method offers an excellent example of the laborious process of abstracting the meaning of concepts.

**ABSTRACT OF TITLE**, an abridged statement of conveyances and encumbrances which appear in public records, concerning a piece of real PROPERTY. Burrill's Law Dictionary says, "An abstract or summary of the most important parts of the deeds, and other instruments composing the evidences of a title to real estate, arranged usually in chronological order. It also contains a statement of all charges, incumbrances, liens and liabilities to which the property may be subjected, and of which it is, in any way, material for purchasers to be apprised." The object of an abstract of title is to enable the purchaser or his counsel to pass on the title quickly, without the necessity of looking up all the deeds, notices, liens, and rights of claims that are connected with the property.

**ABT, FRANZ** (1819-85), German song composer, was born at Eilenburg, Prussian Saxony, Dec. 22, 1819. From 1841 to 1882 he served as chapel-master at Bernburg, Zurich and Brunswick. He wrote more than 200 songs, many of which gained world popularity. One of the best known is *When the Swallows Homeward Fly*. He died at Wiesbaden, Mar. 31, 1885.

**ABT, ISAAC ARTHUR** (1867- ), American physician, was born in Wilmington, Illinois, December 18, 1867. After a preliminary medical course in Johns Hopkins University, he graduated from the Chicago Medical College in 1891. He did postgraduate work in Vienna and Berlin, after which he returned to Chicago, where he was professor of diseases of children in Northwestern University Medical School

(1897-1901), associate professor of diseases of children in Rush Medical College (1902-08), and professor of diseases of children in Northwestern University Medical School in 1909, which position he has held since that date. He is a member of practically all important societies associated with diseases of children and was president of the American Pediatric Society (1926-27). He had conferred upon him the order of Chevalier of the Legion of Honor of France. In addition to the small volume on *Baby Food*, published in 1917, he is editor of the great eight-volume system of Pediatrics, published in 1928.

**ABU-BEKR** (573-634), friend and father-in-law of MOHAMMED, the prophet's immediate successor and the first caliph, was born about 573. Abu-Bekr accompanied Mohammed on the Hegira from Mecca to Medina in 622 and shared his varying fortunes until in 632 at Mohammed's death Islam was master of all Arabia. It was natural therefore that he, the closest friend of Mohammed, should be the successful candidate for caliph (Arabic for Successor). He continued the program marked out by the prophet. His first achievements were to stamp out dissension between Mecca and Medina, subdue the rebellious Bedouins in their protest against taxation, and lead an ambitious marauding expedition into Syria. Under the able generalship of Khalid, Abu-Bekr's power was consolidated at home, and the extension of Islam at the expense of the Byzantine Empire and Persia was begun. But before this thrust was really launched Abu-Bekr died, in 634. He was succeeded by Abu Hafra Omar, in whose reign the era of the great Moslem conquests was inaugurated.

**ABULFEDA** (c. 1273-1331), Syrian historian and geographer, descendant of the Moslem ruler Saladin, was born at Damascus about 1273. His youth was spent in study and as a member of military expeditions against the Crusaders until in 1298 he became one of the followers of the Mameluke Sultan Malik Al Nasir. He was successively governor, prince and sultan of the province of Hamah in Syria, receiving the last title in 1320. Abulfeda was recognized as a generous patron in the literary world and himself became favorably known through his two famous compilations, *An Abridgment of the History of the Human Race*, covering the period from creation until 1329; and a *Geography* (in 28 sections) dealing statistically with the chief cities of the world. Partial translations of these works in Latin, German and French are extant. Abulfeda died in 1331.

**ABUNDANT NUMBER**, a number less than the sum of its aliquot parts. For example,  $12 < 1 + 2 + 3 + 4 + 6$  and hence is an abundant number. See DEFICIENT NUMBER, PERFECT NUMBER, NUMBER THEORY.

**ABU SIMBEL** or **IPSAMBUL**, the site in Upper Egypt of three celebrated rock-temples, situated on the west bank of the Nile about  $22^{\circ} 25'$  N. lat. The temples were built in the face of a precipitous cliff by Rameses II (c. 1300-1250 B.C.), and the largest of the three has been described as the most heroic monument carved from rock. This temple is guarded at

its entrance by four colossi, each 65 ft. high, two placed on each side of the entrance. About their feet are stone representations of Rameses's queen and her children. At the top of the façade, above the forecourt where the colossi are seated, is a cornice, 100 ft. above the floor, which bears a dedication to the solar gods, Raharakht of Heliopolis and Amenra of Thebes, and immediately above this is a line of apes, facing east. The temple within is equally impressive. A



COLOSSAL STATUES OF RAMESSES II ON THE FAÇADE OF ONE OF THE TEMPLES OF ABU SIMBEL

succession of nine halls extends 185 ft. into the sandstone hill. Colored sculptures adorn the walls and mural decorations portray events in the life of Rameses, notably his triumph over the Hittites at Kadesh. The second temple, to the south, was apparently built as an antechamber. The third temple is on the north side, and is fronted by six colossi, 33 ft. high, two among them being images of Rameses and Queen Nefrere. The temples, constantly threatened by encroachments of sand, were discovered in 1812 by J. L. Burckhardt. Severe fissures in the three colossi of the first temple were repaired in 1912.

**ABU TAMMAM** (c. 807-846), Arabian poet, was born at Jasim, near the Sea of Galilee, about 807. He achieved high renown as a writer of laudatory verses, but his reputation rests on his collections of early poems, known as the *Hamasa*, or *Heroic Anthology*, which has often been translated into Occidental languages. Abu Tammam died at Mosul in 846.

**ABUTILON**, called also Indian mallow, a large group of tropical or semi-tropical plants, many of which, sometimes known as flowering maples, are potted or used for bedding. The long-stalked leaves are often very maple-like; the showy, attractively veined, drooping flowers vary from red to white and yellow. The velvet-leaf (*A. Theophrasti*), native to southern Asia and naturalized in the United States, is often a troublesome weed.



**ABUTMENT**, that part of a wall or **PIER** which takes the weight thrust of the construction above it, such as from an **ARCH**, truss or vault.

**ABYDOS**, an ancient city of Upper Egypt, situated about 6 mi. west of the Nile in  $26^{\circ} 10' \text{ N. lat.}$ , indicated since the beginning of the Christian era by only the ruins of temples and tombs. The famous Abydos Tablet containing a list of the predecessors of Rameses the Great was found in 1818, and is now in the British Museum. In 1864 a similar historical tablet was unearthed and in recent years excavations have brought to light important remains of Egyptian dynasties. The reputed burial place of Osiris, the Lord of the Dead, is surrounded by the tombs of countless thousands who sought to be buried near him. Abydos dates back to the dawn of Egyptian history.

**ABYSSAL ROCKS**, or plutonic rocks, are those **IGNEOUS ROCKS** injected in a molten condition, or **MAGMA**, into the deeper portion of the solid crust of the earth. Derived from the heated **ASTHENOSPHERE**, where the rock-forming materials are molten, or potentially so, they solidify as **BATHOLITHS**, **LACCOLITHS**, **STOCK** and **domes**. Because slowly cooled, they show coarsely granular texture. See also **PETROLOGY**.

**ABYSSINIA**, officially **ETHIOPIA**, an inland country and empire occupying the highlands of north-east Africa, between  $5^{\circ}$  and  $15^{\circ} \text{ N. lat.}$  and  $35^{\circ}$  and  $42^{\circ} \text{ E. long.}$ , bounded by Eritrea on the north, Kenya on the south, Somaliland on the east and the Sudan on the west. Estimated area, 350,000 sq. mi. The only wholly independent native state in Africa, it has never been subject to any foreign power.

The Abyssinians, who number about one-third of the population, are of Hamitic origin, with both Semitic and Negro admixture. Ethiopia is the ancient name of part of the country. The name Abyssinia is derived from a word meaning "mixed." The bulk of the non-Abyssinian population consists of Hamitic Gallas, mostly Mohammedan. Somali tribes inhabit the east and southeast, and negro tribes the southwest. The people are very backward, and as yet there are practically no schools. The Abyssinians preserve a debased form of Christianity derived from the Coptic Church of Egypt. The country is wild and undeveloped, consisting mainly of a mass of mountains. There are some lofty peaks, of which many are snow-capped. The summit of Ras Daschan in the Semien range reaches a height of 15,100 ft. It stands northeast of Lake Tsana or **DEMBEA**, which occupies a depressed region at a height of 5,750 ft. above sea level, and from which the Blue Nile issues. There are many hippopotami in the lake, the highest recorded water in which they are found. Most of the heights are crowned with open plateaus where the greater part of the population lives.

**Towns and Communications.** **ADDIS ABABA**, pop. 80,000, lies in the Shoa country; **HARRAR**, pop. 45,000, is an old walled city and an important trading center on a fertile upland famous for its coffee. Gondar, 3,000, the ecclesiastical capital, has caravan

routes to Khartum and Berber, and is connected across the Blue Nile with Addis Ababa. The chief railway is the single line, meter-gauge railway, 386 mi. long, from Jibuti, the French port in Somaliland, through Dire Dawa, pop. 30,000, to Addis Ababa, the present capital. The position of the capital has varied; it was fixed at Addis Ababa owing to the planting and conservation of woods of eucalyptus to provide fuel.

**Products.** Abyssinia lives largely for itself. There is little incentive to produce for export, and primitive agricultural methods prevail, although a modern reaper and binder may occasionally be seen. The wants of the people are simple, so that there is little demand for foreign goods, and internal trade is still largely a matter of barter. There is a large variety of products, both animal and vegetable. The lower portions of the country have a tropical climate and produce cotton; and on the slopes grows the coffee plant, which is a native of this region; higher up, fruits such as the grape are cultivated. Above this belt are grasslands where horses, sheep and goats are reared, and where wheat and barley are grown. Minerals have not yet been exploited, although there is believed to be mineral wealth. Gold mines are worked in a few areas. Iron is worked for native requirements, some alluvial gold has been found in places difficult of access, and an attempt has been made by Italy to exploit potash deposits on the Eritrean frontier.

The Queen of Sheba is supposed to have been ruler of Ethiopia in Solomon's time. Modern Abyssinia is ruled by a king or *negus*, assisted by governors in charge of the provinces. In recent years the rulers have tried to modernize the government, which is of a feudal character. Est. pop. 10,500,000.

**ABYSSINIAN CHURCH**, known also as the Coptic Church of Abyssinia, was founded in the 4th century by Frumentius, Bishop of Axum, who in 330 was created the first bishop of Ethiopia. Little is known of the churches which came within his jurisdiction until about 1520, when Abyssinia received some Jesuit missionaries and an embassy from Portugal. The Church has kept its connection with the Alexandrine church through the abuna, or head bishop, who is appointed by the Coptic patriarch of Alexandria. It is estimated that about a quarter of the adult male population of Abyssinia is composed of priests, monks and deacons, and that a third of the country belongs to the Church, which exercises great influence. The Septuagint version of the Scriptures is used, saints and angels are venerated, but images are forbidden. Confession, absolution, fasts and pilgrimages to Jerusalem form part of the Church requirements.

**ACACIA**, in botany, a well marked genus of trees and shrubs, belonging to the mimosa tribe of the pea family, comprising many important economic plants and also numerous ornamentals. There are about 500 species native to tropical and subtropical regions, 300 of which are found in Australia; about 12 species occur in the southern United States. They are mostly

medium-sized, quick-growing, short-lived shrubs and a few are herbaceous. The foliage is of two distinct kinds, being either much divided, graceful and fern-like or, as in the Australian species, reduced to simple expansions of the leaf stalks (phyllodia), which serve in the place of leaves. In most species the small regular flowers, usually orange-yellow but varying to white, are borne in oblong spikes or globular heads. The fruit is a true pod (legume), oblong, linear or moniliform in shape and opening by two valves.

Among the acacias yielding valuable products are *A. Senegal* of the Sudan, the source of the best gum arabic; *A. Catechu* of the East Indies, producing the tanning substance catechu with which the true khaki cloth is dyed and shrunk; the black wattle (*A. decurrens*) and other Australian wattles yielding tan bark; the blackwood (*A. melanoxylon*) of Australia, used for cabinet work, and the huisache (*A. Farnesiana*) furnishing the cassie flowers of perfumery.

A large number of acacias, especially the rapidly growing kinds, are planted as ornamentals out of doors in the southern United States, especially in California; several are favorites in greenhouse cultivation. Among the ornamental acacias are the kangaroo thorn (*A. armata*), the hairy wattle (*A. pubescens*), the golden wattle (*A. Pycnantha*), the weeping myall (*A. pendula*) and the broom wattle (*A. calamifolia*). Of the acacias which grow wild in the United States five attain the size of trees, the best known of which are the huisache and the cat's claw.

In medicine a 35% solution of gum arabic, preserved with sodium benzoate, is known as mucilage of acacia. It is used as a demulcent and as a suspending agent in making emulsions and mixtures.

See also CAT'S CLAW; HUISACHE; KANGAROO THORN; PHYLLODE. A. B. J.

**ACADÉMIE FRANÇAISE.** Wishing to purify the French language, CARDINAL RICHELIEU offered a group of *littérateurs*, who had been holding informal and brilliant meetings, organization as a public society under the protection of the king. The proposition was accepted, and this body, called *l'Académie française*, met for the first time in Mar., 1634, although Parliament delayed the granting of the charter until 1637; membership was limited to 40 with a director, chancellor and secretary. The *Académie* was to engage itself solely with the purification and fixation of the French language by the publication of a dictionary, a grammar, a rhetoric and a book on poetry. The first edition of the dictionary did not appear until 1694 and the last and seventh was issued in 1877. It was not until the fourth edition that the language of common usage, the language of the people, was considered. Previously, the speech used by the aristocrats had been employed as the criterion.

When the Convention of 1795 created the *Institut de France* it made the *Académie* one of its branches. Conservatism and timidity have characterized the régime of the *Académie*. Although many great writers have been admitted, such as La Bruyère, Racine,

La Fontaine, Montesquieu and Bergson, yet the omission of such names as Descartes, Pascal, Rousseau, Comte, Stendhal, Flaubert and Zola is a scathing indictment. (See also biographies of men mentioned.) However, the *Académie*, in emphasizing consummate craftsmanship and conscientious effort in writing, has performed a real though indirect service to literature. It is chiefly known now for its function as an honor society.

**ACADEMIES**, places of instruction or learning, in America usually preparatory or high schools, or institutions where the training of some special science or art is given, as in the United States Naval Academy at Annapolis, Md. The term academy, which was derived from the suburb of ancient Athens where Plato and his followers established a school, is also applied to learned societies formed by the association of scholars for the promotion of literature, art or science. In America the foremost example of this type of society is the American Academy of Arts and Letters. See ACADEMY OF ARTS AND LETTERS, AMERICAN.

Academies in England were the outgrowth of the Nonconformist need of education at the time of the Restoration. They were in reality universities which were established without Papal sanction. In America the academy was the development of somewhat similar circumstances. It went beyond the limits of the grammar schools of that time which prepared only for a university education, and provided the broader training and more flexible instruction that the new country required. Benjamin Franklin's Philadelphia Academy, established in 1741 and opened ten years later is usually regarded as the first true American academy.

By the end of the 18th century the academy type of school was definitely established in all parts of the new nation. It continued to flourish until the middle of the next century when the movement began its decline. This was caused by the trend toward public control and support of popular education. Many academies became high schools, although the better endowed schools of that type remain to-day as important preparatory schools. Among these are the Phillips Academies at Andover and Exeter, and Mercersburg Academy in Mercersburg, Pa.

**ACADEMY, GREEK**, a school of philosophy founded and presided over by Plato for some 50 years and was continued for several centuries after his death under head masters known as scholars. The first to occupy this position after Plato's death was his nephew Speusippus.

The historical activity of the Academy is divided into three periods designated as the Old, the Middle and the New Academy. Of the scholars of the Old Academy Crates and Xenocrates are best known. During this period the teachings followed largely along the lines laid down by the founder. Hence this period is called the dogmatic. The Middle Academy was founded by Arcesilaus and was characterized by scepticism. Arcesilaus went further than Socrates, who had declared that the only thing he knew was

that he knew nothing; Arcesilaus did not even feel quite certain on this point. With Carneades, the founder of the New Academy, scepticism ceased to be quite so negative and became more of a theory of probabilism. Although we cannot be certain of knowledge nevertheless we have reasonable probabilities upon which it is safe to act. The Academy was discontinued by Justinian in 529, along with other pagan schools.

**ACADEMY OF ARTS AND LETTERS, AMERICAN**, a society founded in 1904 by the National Institute of Arts and Letters and consisting of its most distinguished members. The membership is limited to 50 of those who have distinguished themselves in the arts such as literature, painting, sculpture, music or architecture. The original seven members chosen by secret ballot of the Institute were William Dean Howells, novelist; Edmund Clarence Stedman, poet; Samuel Langhorne Clemens, humorist; John Hay, author and statesman; Augustus Saint-Gaudens, sculptor; John LaFarge, painter; and Edward Alexander MacDowell, composer. These men were authorized to choose 8 additional members, the 15 selected 5 more and these 20 chose an additional five. The remaining 25 were elected by a majority vote of the society. Vacancies are filled in the same manner.

In 1916 the Academy received a national charter from Congress and in 1923 it established a permanent home. A second building, designed by Cass Gilbert, a member of the Academy, was opened in Nov. 1930, and contains an auditorium and art gallery for exhibitions of the work of members.

The Academy encourages artists and writers by the award of medals for outstanding work. Its gold medal is awarded at irregular intervals, always to a non-member. It was given in 1929 to Anna Hyatt Huntington, sculptor. The Howells medal for the best American fiction is awarded every five years, and was received by Willa Cather in 1930. The medals for good diction on the stage and over the radio, awarded at intervals, were received in 1930 by George Arliss and Alwyn Bach respectively.

**ACADIA**, the French name for Nova Scotia and adjoining parts of New Brunswick and, at first, Maine. After 1603, when Henry IV granted the lands to SIEUR DE MONTS, some settlements were made, but with little success except about Grand Pré at the head of the Bay of Fundy. In 1713 the district was seized by the English and renamed Nova Scotia. In 1755 many of the French were expelled, some scattered among the Atlantic colonies, some sent to Louisiana where their descendants still live. The expulsion of the settlers was the theme of Longfellow's poem *EVANGELINE*.

**ACADIA NATIONAL PARK**, a tract of 11,131.50 acres on the coast of Maine, comprising a group of granite mountains on Mt. Desert Island and a bold point on the adjacent mainland across Frenchmans Bay. In 1914, an area of 5,000 acres was presented to the nation by private citizens and given the

name of Sieur De Monts National Monument. On Feb. 26, 1919, it was enlarged and proclaimed Lafayette National Park and on Feb. 19, 1929, it was again enlarged and renamed Acadia National Park. This name is peculiarly fitting as it is derived from an Indian word describing the region, was adopted by the earliest European visitors and was later made famous by Longfellow's poem, *Evangeline*.

The scenery of the park is said to be the most beautiful on the entire Atlantic coast of the Americas with the exception of the harbor of Rio de Janeiro. More than a dozen rugged granite peaks rise to a maximum altitude of approximately 1,500 ft. Many come right down to the water's edge and are pounded and ground away by the waves into jagged inlets and caves. Somes Sound, a picturesque glacial fiord, cuts deep into the island.

Numerous fresh water lakes surrounded by pine, cedar and a wide variety of deciduous trees lie in the hollows of the mountains, and a profusion of shrubs and flowering plants adds to the charm of the forest. The mountain tops command magnificent views of the sea and sound, the island and wooded mainland. Mt. Desert Island was discovered by CHAMPLAIN in 1604 and was the site of the first French missionary colony in America. In 1713, the island became the property of the English crown.

The park is open to the public the year round. There are over 200 mi. of trails and footpaths on the island, also extensive bridle paths and motor roads. Public camping grounds are maintained in the park for visitors with their own camping outfits. Railroads connect Bar Harbor with all eastern cities. The Eastern Steamship lines maintain daily service from Boston to Bar Harbor.

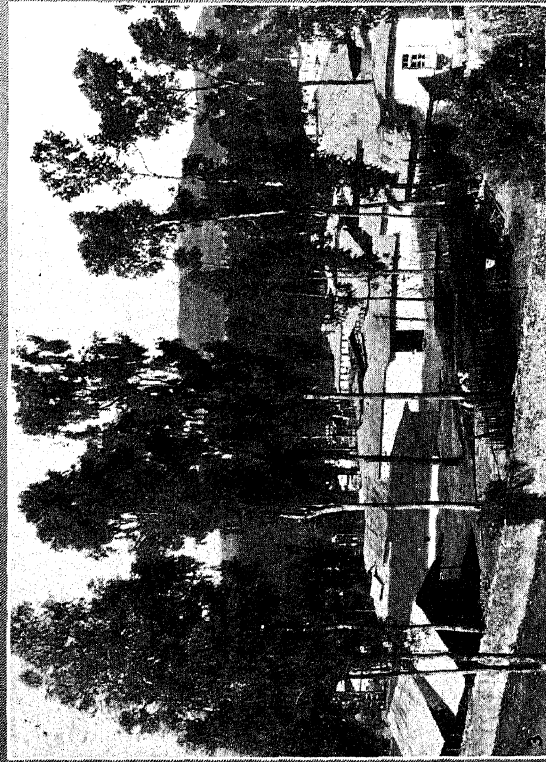
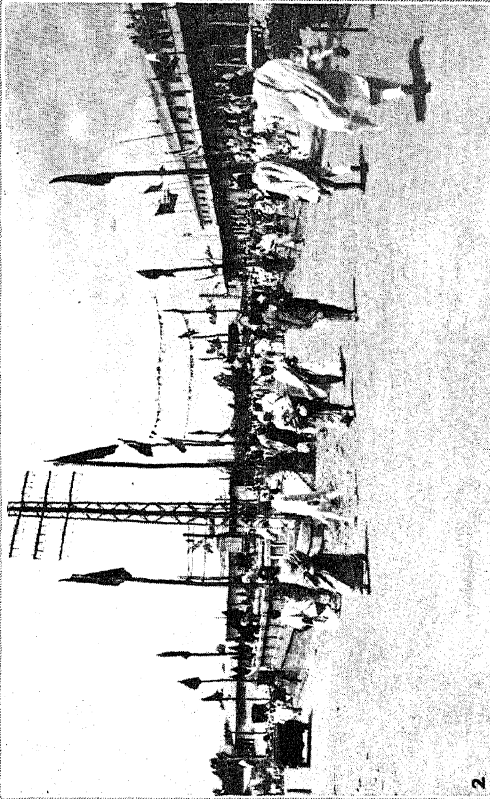
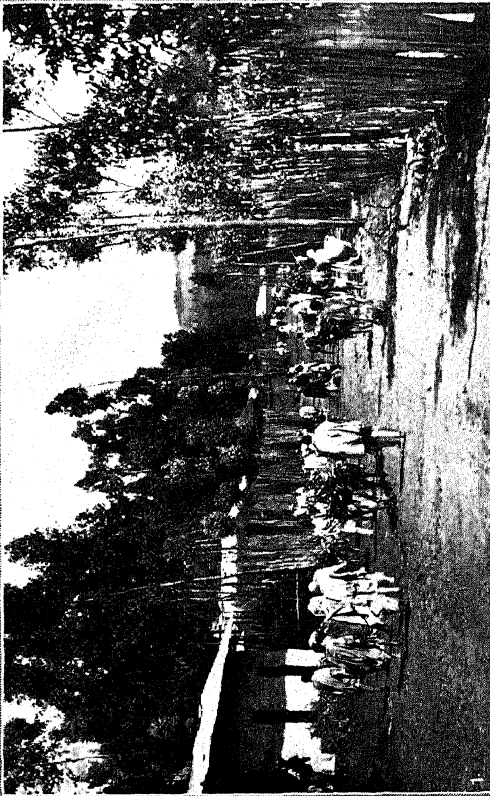
The park is accessible by motor from all eastern points over good state highways. It is 187 mi. from Portland, Maine, 305 from Boston, and approximately 600 from New York. A steel and concrete drawbridge connects the island with the mainland.

**ACADIA UNIVERSITY**, at Wolfville, N.S., Canada, a coeducational and non-sectarian institution founded in 1838 by the Nova Scotia Baptist Education Society, and incorporated in 1840. Its total income in 1929-30 was approximately \$130,000. The library contains 65,000 volumes. In 1930-31 there was a student enrollment of 508, and a faculty of 50 headed by Pres. F. W. Patterson.

**ACANTHUS**, the name given to a group of thistle-like plants, native chiefly to the Mediterranean region, several of which are grown as ornamentals. They are handsome plants, with stems about 3 ft. high; large much-divided, usually spiny-toothed leaves, and showy clusters of red, purple or white flowers.

**ACANTHUS**, in architecture and the decorative arts, the most widely used, in all European styles, of any decorative form based on an actual plant. It first appeared in Greek carved ornament sometime in the later 5th century B.C., combined often with the anthemion, as in decorative bands in the Erechtheum at Athens. It was also adopted as the chief decora-

# ABYSSINIA



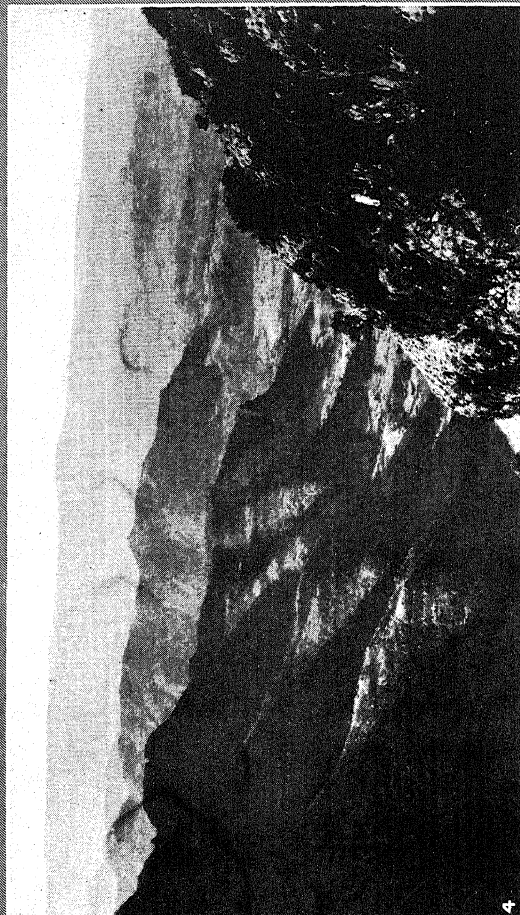
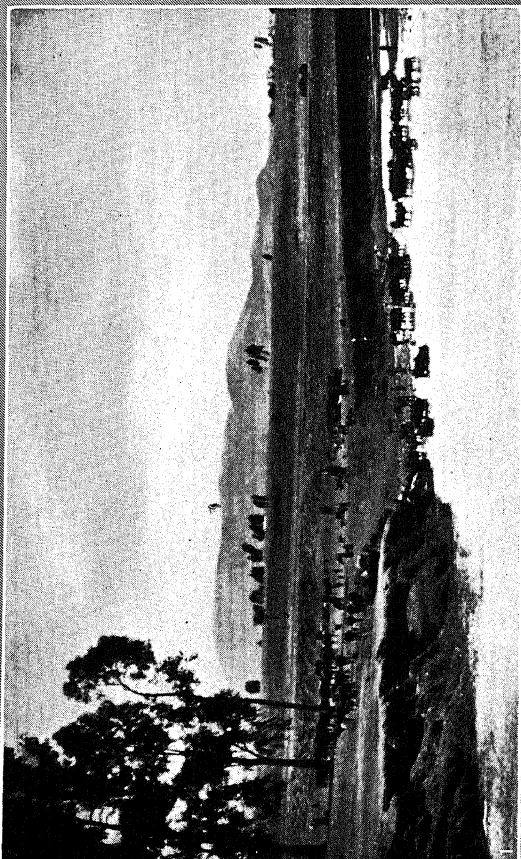
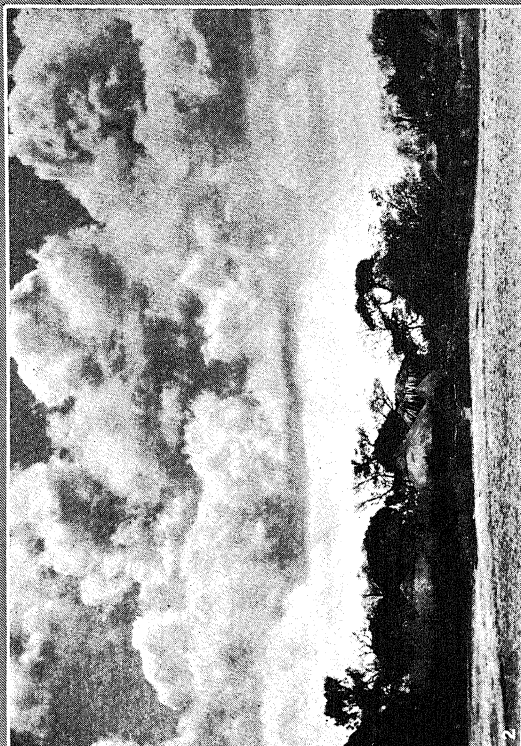
PHOTOS BY NOMLAS

## SCENES AMONG THE PEOPLE OF ABYSSINIA

1. Street in poorer quarter of Addis Ababa.
2. Crossroads scene in business section.
3. Typical dwellings in Abyssinia.
4. Corner of a market place, with fruit and vegetable growers displaying their produce.



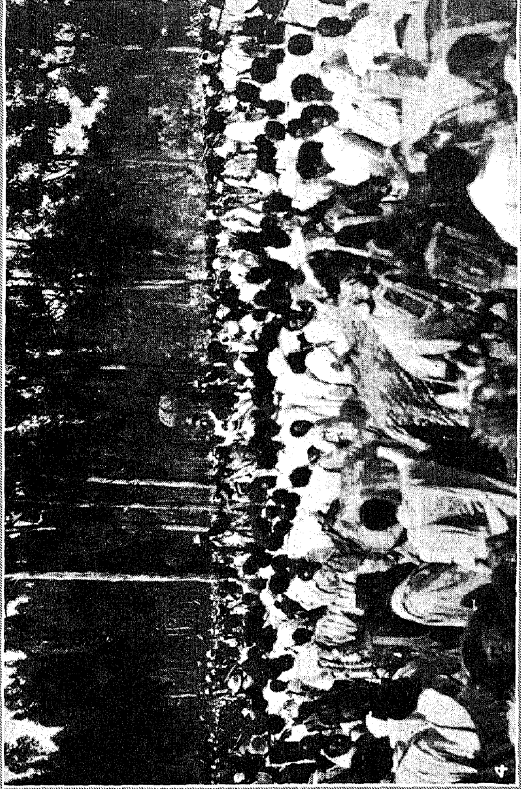
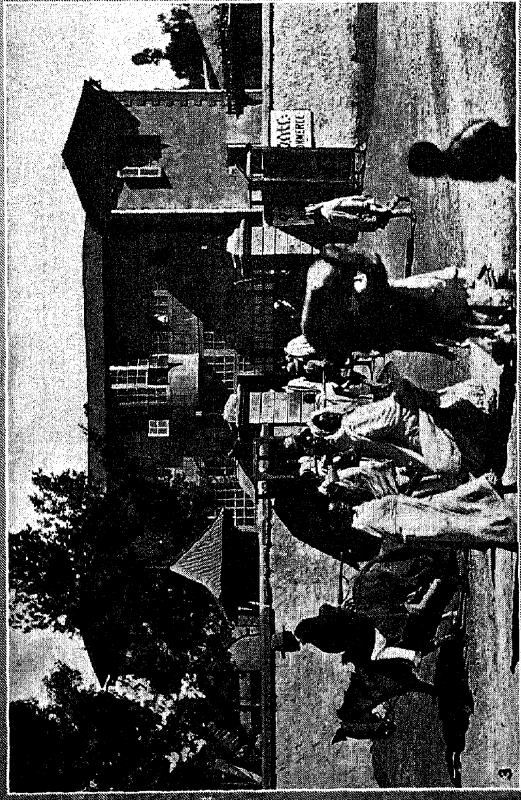
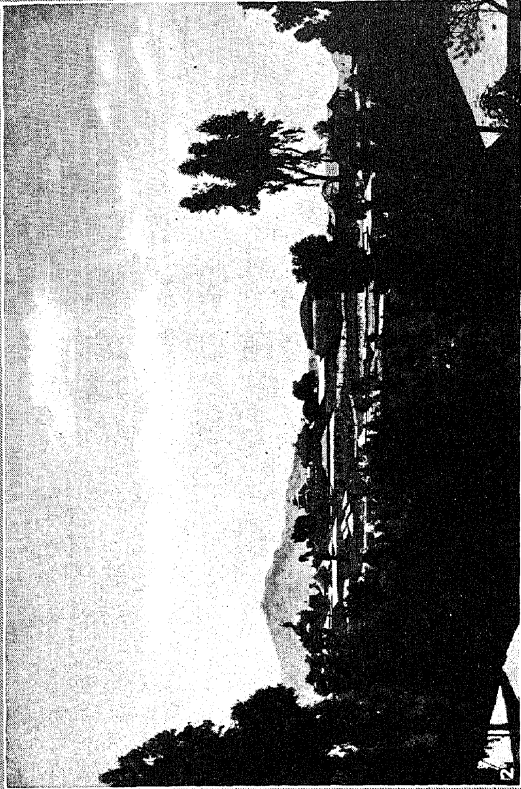
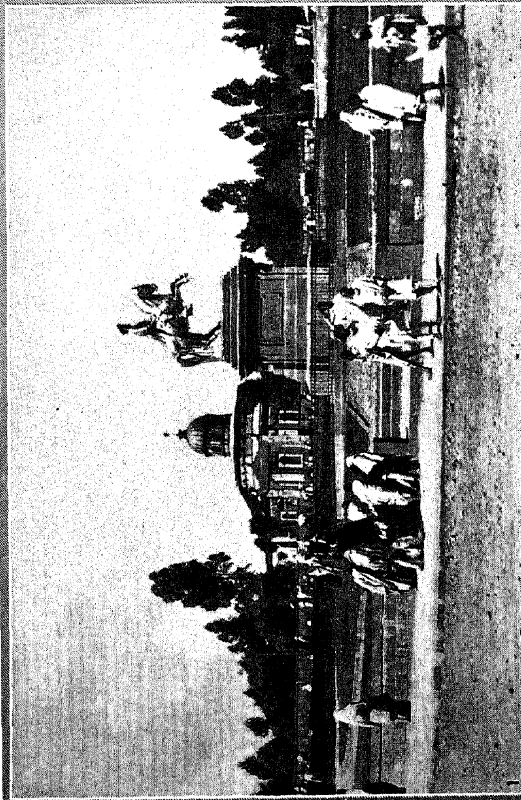
# ABYSSINIA



## RURAL VIEWS OF ABYSSINIA

1. A ford which must be crossed on the way to Akaki.
2. A small country village.
3. The valley of the Muger River, 6,000 ft. deep.
4. A view of another section of the Muger River valley.

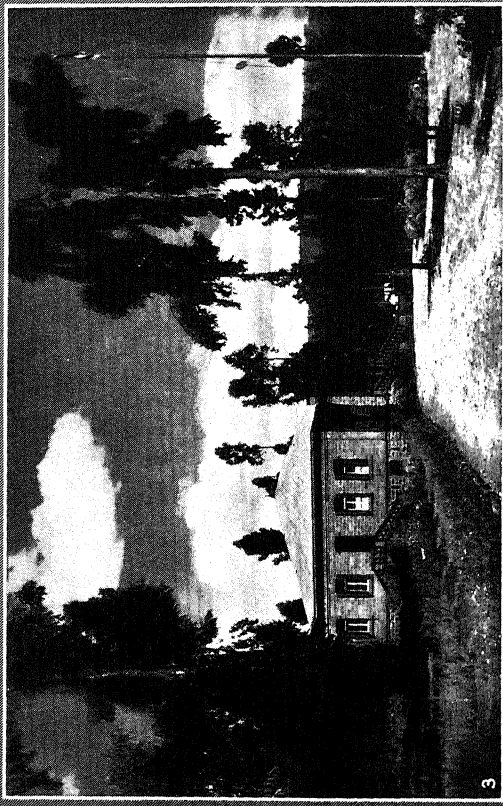
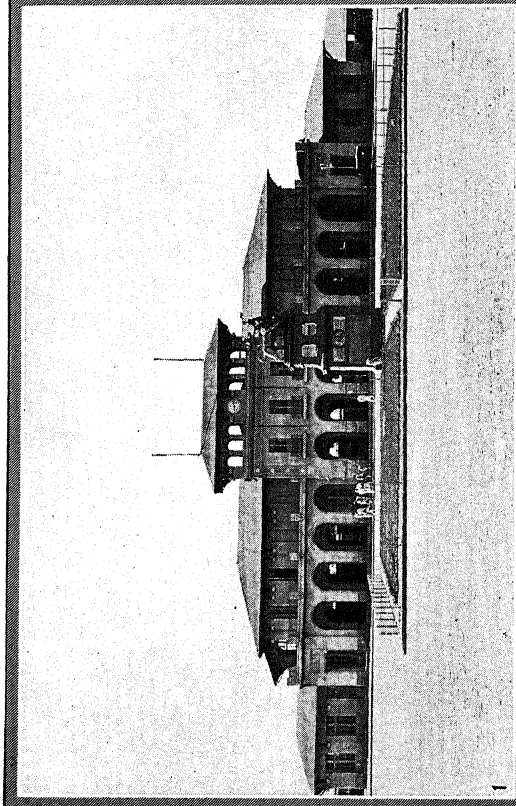
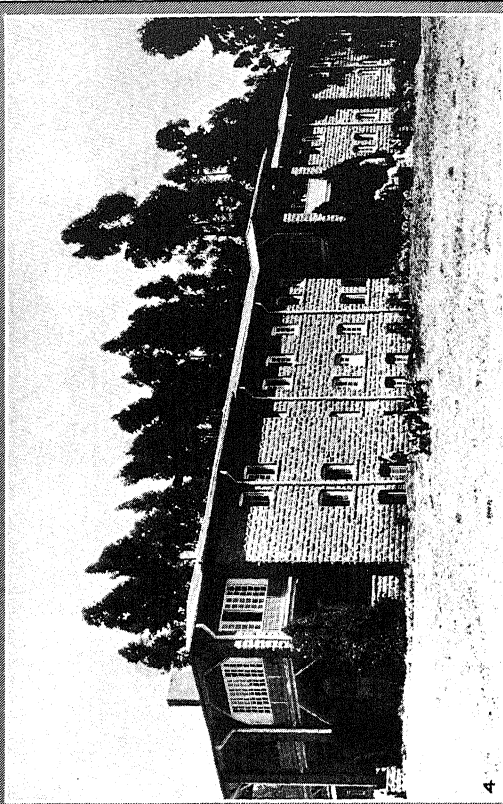
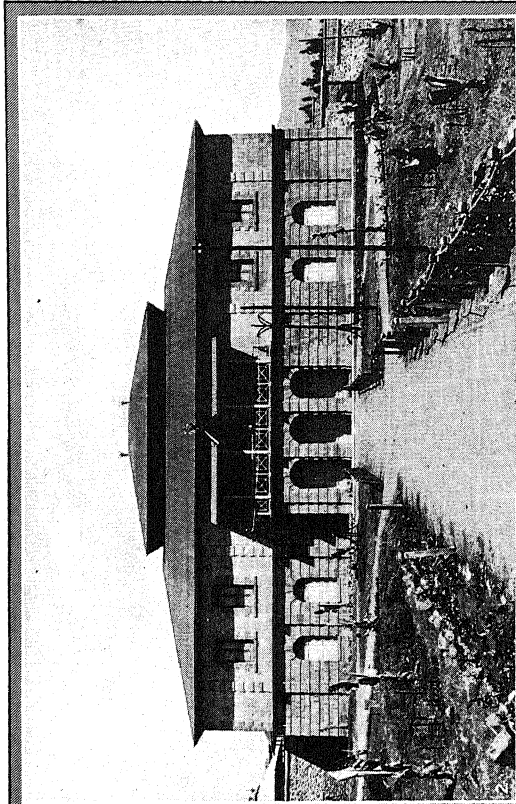
# ABYSSINIA



## ADDIS ABABA—METROPOLIS OF ABYSSINIA

1. Statue of the great emperor, Menelik II.
2. The Gibbie, or the Imperial Palace.
3. The Ministry of Commerce at Addis Ababa.
4. The celebration of the Temkat, an Abyssinian religious festival.

# ABYSSINIA

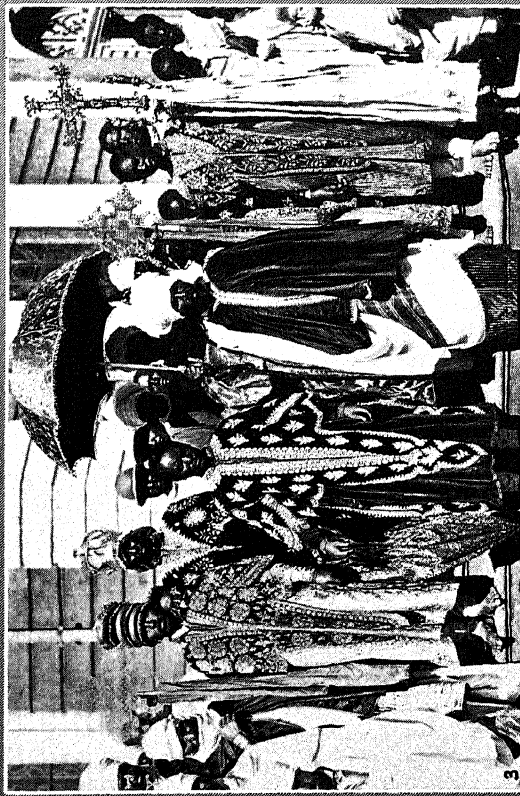
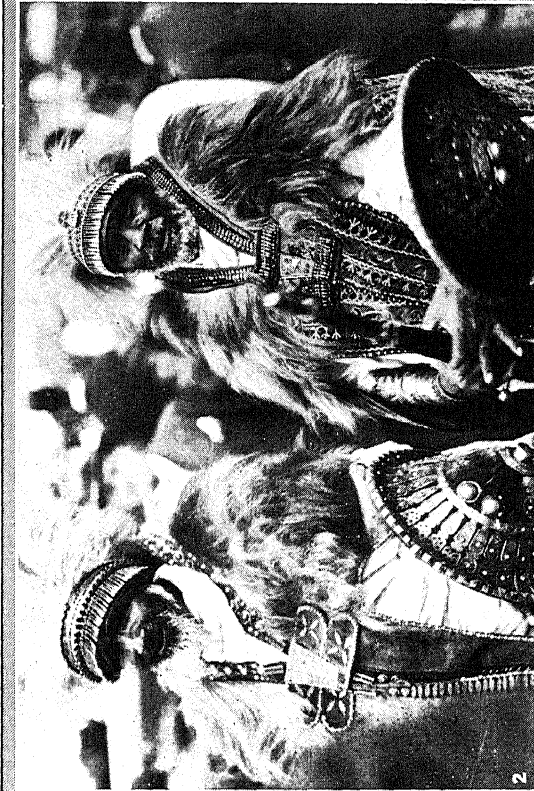


## VIEWS IN THE CAPITAL OF ABYSSINIA

1. The modern railroad station at Addis Ababa.
2. Foreign Office of the Abyssinian government.
3. One-story building housing the American Legation.
4. American Hospital, Addis Ababa, with modern equipment.



# ABYSSINIA



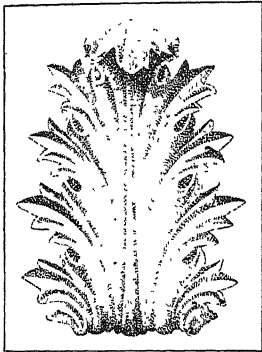
HAILE SELASSIE I AND ABYSSINIAN DRESS AND ART

1. Haile Selassie I, the "king of kings" of Ethiopia.
2. Warriors in the military costume of Menelek II.
3. Priests dressed in their ceremonial robes.
4. Ethiopian boys with a native painting of a hunting scene.





tion for the Corinthian Capital (*see* ORDER), conventionalized acanthus leaves being ranged around the bell. Both spiky and round ended forms were used; the first was most common in Greek work, and the second in Roman.



COURTESY P & P CAPRONI BROS  
ACANTHUS LEAF

**A CAPPELLA**, or unaccompanied vocal music, is so named because this term signifies, in Italian, "according to the chapel" or "church style," and because all church music was formerly unaccompanied; the alternate term is *alla cappella*. The same term is also occa-

sionally used to indicate *alla breve* time because the *breve*, a note having twice the value of the *semibreve* or whole-note, was formerly a common standard of measurement in ecclesiastical music.

**ACAPULCO**, a seaport of Mexico, on the Pacific, in the state of Guerrero, with a fine landlocked harbor, a port of call and coaling station for steamers plying between North and South American ports. The place was partly destroyed by earthquake shocks in 1909. Pop. 1921, 5,768; est. 1930, 10,000.

**ACCADIAN**, a SEMITIC LANGUAGE spoken by the Babylonians and Assyrians, historically the earliest attested member of the group, but not the oldest in grammatical type. Its script, which is CUNEIFORM, consists partly of syllables (*ab, ba, ga*, etc.) and partly of IDEOGRAMS; but since this script was taken over from the non-Semitic SUMERIAN, Accadian lost one of the most striking peculiarities of the Semitic alphabet, namely the gutturals. Its phonology is extremely simplified from the proto-Semitic stage through coalescence of consonants originally distinct and assimilation of consonant-groups. There are three TENSES, present, preterite and permansive, the first expressing an incomplete action and the second a completed one, while the permansive developed from the verbal noun and is generally used as a past participle. The verb has the following stems: simple, intensive (doubling of the second radical), causative (prefixed *sh*), and passive (prefixed *n*). A secondary reflexive group is formed from every one of these stems by the insertion of *t* after the first radical, and finally, a third group is built by adding the syllable *-tan*. The case-endings in classical Accadian were *-um, -im, -am* (dual *-ān, -en*; plural, *ū, ī*); but in the middle period the final *m* (the so-called mimation) was dropped altogether, and the feeling for the meanings of the case-endings became so weakened that they were used indiscriminately. Accadian syntax differs from that of the other Semitic languages by the position of the verb, which is at the end of the sentence. Accadian was spoken from 3000 to about 300 B.C., spreading from Babylonia to Assyria, and thence to Cappadocia

until, in the 14th century B.C., it was the diplomatic language of the Near East. I. M.

BIBLIOGRAPHY.—S. Mercer, *Assyrian Grammar*, 1921; A. Ungnad, *Babylonisch-assyrische Grammatik*, 1926.

**ACCELERATION**. *See* VELOCITY.

**ACCELERATOR**, a throttle valve for controlling the power and speed of a MOTOR VEHICLE. It usually actuates a part of the CARBURETOR and is operated by the accelerator pedal in the floor of the vehicle or by a hand lever on the steering wheel.

**ACCELEROMETER**, an instrument which measures linear accelerations, used chiefly with aircraft. It consists, essentially, of a small mass that may move in a straight line but is restrained from this motion by means of a spring or other elastic member. If a body to which the instrument is attached undergoes ACCELERATION, this causes the INERTIA of small mass to deflect the restraining spring. That deflection is a measure of the acceleration.

Accelerometers may be of the indicating type, in which case the accelerations are indicated on a dial. However, they are usually of the recording type, which record the accelerations by means of a stylus in contact with a moving sensitized surface. In the most successful accelerometers used to date the elastic member has been a cantilever or a coil spring, a glass fibre or a metallic diaphragm. The accelerometers most widely used in aircraft loading studies are the recording accelerometer of the National Advisory Committee for Aeronautics and the accelerometer of the Royal Aircraft Establishment. J. W. C.

BIBLIOGRAPHY.—F. H. Norton and E. T. Allen, *Accelerations in Flight*, 1921; *Preliminary Report on Measurement of Acceleration on Aeroplanes in Flight*, 1917.

**ACCENT**, emphasis upon either a syllable of a word containing more than one syllable ("word-accent") or upon a word of a sentence or clause ("sentence-accent"). Word-accent is of two types: qualitative, depending upon the character of the vowel in the syllable accented; and quantitative, depending upon the length of such vowel and prolonging the duration of utterance of the accented syllable, notably by lengthening short vowels or making long vowels super-long. Qualitative accent again falls into two classes: "stress-accent," also termed "expiratory" or "intensity-accent," marked by exertion of greater physical force in pronouncing the accented syllable; and "musical accent," also called "pitch-accent," marked by raising or lowering the pitch of the voice in pronouncing such syllable.

Stress-accent has always been prevalent, so far as known, in every INDO-EUROPEAN LANGUAGE except Vedic SANSKRIT before the 4th century B.C., GREEK until the 4th century A.D., and LITHUANIAN. Generally speaking, it tends to retain the vowels of accented syllables, while long vowels in unaccented syllables are shortened, and short vowels there become further weakened or disappear. It is, accordingly, one of the chief factors in vocalic alternation (*see* ALTERNATION, VOCALIC). Musical accent, characteristic of Vedic Sanskrit, Greek and Lithuanian, is of

three types: acute, with rising intonation; grave, with falling intonation; and circumflex, with either falling-rising or rising-falling intonation. It would appear that in the Indo-European period, as still in modern SWEDISH, etc., both stress and pitch could coexist; and this is also implied by Greek poetry, where the stress-accent shown by the meter by no means coincides with the musical accent indicated by the accentuation-marks.

Word-accent may further be either free or fixed, falling either upon different syllables of a word in different forms of its inflection, or fixed on the same syllable throughout. The former system, apparently the more primitive, is characteristic of Sanskrit, Greek, Lithuanian, Russian, Serbo-Croatian, and, originally, of Germanic. L. H. G.

In polysyllabic words one finds a single primary and one or more secondary accents, the latter conditioned by rhythmical considerations, as *antiväletudinarianism*. This is likewise true of sentence-accent, where the word or words felt to be important are stressed; and this accent may also be musical, producing a "singing" effect in the sentence.

BIBLIOGRAPHY.—H. Hirt, *Indogermanische Grammatik*, v. ("Der Akzent"), Heidelberg, 1929.

**ACCEPTANCE CORPORATION**, a corporation organized to do a foreign or international banking business and whose principal function is to issue dollar credits and accept drafts drawn upon them. This type of banking corporation came into existence in the United States, following an amendment to the FEDERAL RESERVE ACT in 1916 allowing member banks to invest up to 10% of their capital and surplus in such a corporation.

They operate under certain restrictions imposed upon them by the Federal Reserve Board. They must not receive domestic deposits, but may receive deposits which are incidental to carrying out transactions in foreign countries or dependencies of the United States. Against these deposits a reserve must be maintained which corresponds to that required against deposits of member banks located in central reserve cities.

Acceptance corporations may accept drafts and **BILLS OF EXCHANGE** for all transactions that are permissible to member banks under the provisions of the Federal Reserve Act, provided they make, at any one time, no acceptance on the account of any one drawer in excess of 10% of their subscribed capital and surplus, unless the transaction be fully secured, or unless it represents exportation or importation of merchandise and is guaranteed by a bank or banker of undoubted solvency.

At no time shall the aggregate of all acceptances outstanding plus the total of deposits held by any acceptance corporation exceed six times the amount of that corporation's capital and surplus through the approval of the Federal Reserve Board. Against all outstanding acceptances these corporations must maintain a reserve of at least 15% of liquid assets.

Acceptance corporations are required to make two

reports annually to the Federal Reserve Board covering such details of their operation as may be prescribed and are subject to such examinations as the Board may order.

By an amendment to Section 25 (a) of the Federal Reserve Act passed in 1918, commonly known as the Edge Act, the Board was authorized to issue a Federal charter to corporations organized for the purpose of engaging in international or foreign banking or other international or foreign financial operations. These acceptance corporations are governed by the provisions of the Federal Reserve Act Section 25 (a). *See also* FEDERAL RESERVE SYSTEM. R. H. B.

**ACCESSORY**, in criminal law, is one who contributes to an offense. Accessory *before the fact* is one who, though absent when the crime was committed, procures, counsels or commands it. Accessory *after the fact* is one who, knowing a FELONY has been committed, conceals it from the magistrate and assists the felon to escape or harbors or protects him.

**ACCESSORY MINERALS**, in a rock, are those which occur in such small quantities, or so rarely, that they are useless for classification or diagnostic purposes. Though unimportant on these grounds, they may give valuable indications of conditions of rock formation and alteration. An accessory mineral of one rock may be important in another. **MAGNETITE**, **GARNET**, **RUTILE** and **TOPAZ** are some accessory minerals. *See also* ROCK; PETROLOGY; MINERALOGY.

**ACCIDENTAL**, in music, is any note not called for by the signature. The symbols indicating these departures from the original scale as established by the signature are called sharps (#), double sharps (##), flats (b), double flats (bb), and naturals (n). A sharp raises a note one degree, a double sharp two degrees, while a flat or double flat lowers a note in a corresponding manner. A natural may raise or may lower a note, since it is a cancellation sign voiding either a sharp or a flat in the signature. Thus, in the scale of F, the natural placed before B raises the latter; on the other hand, in the scale of G, the natural placed before F lowers it.

**ACCIDENT INSURANCE**, protection from loss due to disability or death as a result of accident only. Ticket accident policies may be obtained at the ticket offices of railways and provide for the payment of specific amounts in the event of death or disability by accident within specified periods of one day, one week, 30 days or 90 days. This type of policy does not cover illness or injuries where there is no visible wound and it eliminates many of the accidents most likely to occur; some, however, provide income and double indemnity if death should occur as a result of a specified list of accidents within a period of 90 days from the time of injury. Sometimes the manner in which the accidents must occur is also specified. Unlimited accident policies offer considerable variation in coverage. Most provide for a death benefit of a definite sum which is the basis for all other benefits payable under the policy. Some provide for doubling the benefits under certain conditions and others triple

or even quadruple the payments if the accident occurs on a common carrier.

**ACCIDENT PREVENTION.** Accidents in the United States now cause annually about 100,000 deaths, many million injuries and losses exceeding two billion dollars. The death rate fluctuates greatly from year to year but has a slight downward trend which would be more marked were it not for the constantly increasing deaths from use of the motor vehicle.

General interest in accident prevention was first stimulated by the enactment of workmen's compensation laws. The present safety movement had its birth in industry, where approximately 20,000 accidental deaths occur each year, but has expanded rapidly beyond these confines into the fields of street and highway accidents—32,000 deaths—other public accidents 20,000 deaths—and home accidents—30,000 deaths. In addition to Federal and State bureaus and insurance companies, its chief proponent has been the National Safety Council, which was organized at the first national "Safety Congress" 1911, and has grown rapidly until its membership now includes the employers of 13 million workers.

In essence, accident prevention consists of: (1) elimination of hazard, usually through engineering design; (2) protection, such as guards, railings and goggles and (3) supervisory and regulatory measures, ranging from safety rules and danger signs to legislative enactments. The effectiveness of these has been found to depend upon the "safety education" of those whom they are designed to protect—hence, the employment of many devices intended to maintain interest and impart knowledge such as, safety meetings, committees, posters and the like.

Safety engineers estimate that 98% of accidents are preventable. In some industries and in many plants they have been reduced to an almost unbelievable extent, and excellent results are being obtained by owners of organized fleets of motor vehicles. Safety is now taught in most public schools and child accidents have decreased in consequence. Elsewhere, progress has not been marked. L. D.

**BIBLIOGRAPHY.**—Publications of National Safety Council, Chicago, as, *Accident Facts*; H. E. Beard, *Safety First for Home and School*.

**ACCIDENTS, INDUSTRIAL:** Blindness due to. See **BLINDNESS, MEDICAL ASPECTS OF**.

**ACCOMMODATION**, the process that takes place in an eye whereby the image of an object nearby is focussed accurately on the retina. A normal eye at rest is so built optically that the image of any object at a distance is focussed accurately on the retina (see **EYE**). When the same object is brought near to the eye, still at rest, the rays from that object are no longer brought to a focus on the retina and the image is blurred. In order to overcome this, it is necessary that the lens of the eye acquire a greater refracting power, so that the rays from the object can be made to converge to a focus upon the retina. According to the Helmholtz hypothesis, which is the most uni-

versally accepted theory of accommodation, that increase in refracting power of the lens is accomplished by the contraction of a circular muscle, known as the ciliary muscle, which lies in the eye immediately behind the outer edge of the iris. The edge of the lens is attached to the ciliary muscle by innumerable fine, firm fibers, known as the zonule of Zinn. When the ciliary muscle is at rest, these fibers are under tension and the lens is flattened. This occurs when the eye is at rest and is adapted to see objects at a distance. When the eye is accommodated to see objects nearby, the ciliary muscle contracts, thus loosening the tension on the zonule fibers and permitting the lens to grow thicker. The thicker the lens, the greater the refracting power and the clearer are objects nearby. That power of accommodation begins to decrease between the age of 40 to 50 years, owing to the increasing stiffness of the lens structure and consequent inability to become thicker, such loss being known as presbyopia, or vision of advanced age.

H. S. G.

**ACCOMPLICE**, a participator in a crime which he personally did not commit. *ACCESSORY before*, but not *after* the act, would be an accomplice. It is not essential that the accomplice be present at commitment of the crime. His uncorroborated testimony is not received as evidence against the principal. See also **ABETTOR**.

**ACCORD AND SATISFACTION.** The substitution of a new agreement between the parties for a pre-existing one and execution of the new agreement; or an agreement that one party shall give or do and the other accept something in satisfaction of a right of action of the latter against the former, and execution of that agreement. The agreement is called accord. When executed there is accord and satisfaction.

**ACCOUNTANT**, a person skilled in **ACCOUNTING**. In general there are two classes of accountants—public and private. A public accountant holds himself out to the public as a professional man willing to render accounting service for a fee. In many countries such men are certified or non-certified. The certified public accountant (C.P.A.) has satisfied the educational and experience requirements of a state examining board and has been granted a certificate to practice. In other countries, by satisfying similar requirements of professional societies, such accountants are privileged to call themselves chartered accountants (C.A.) or other similar titles. A private accountant is one in the regular employ of a business enterprise as a member of its operating force. Such are sometimes classified by the kind of business, as railway, hotel and retail accountants.

**ACCOUNTING**, the keeping of a system of records for a business. Bookkeeping is the term usually applied to the actual work of making the record. Accounting refers to the broad body of principles on which the system rests and in accordance with which the record is made. The term is also sometimes used instead of accountancy to refer to the profession built on the practice of accounting. As

used at the present time accounting is usually limited to the financial and operating records of a business.

Records are kept as a means of controlling the activities of a business. Certain basic functions are found in all business enterprises. These functions are usually designated as those of procurement or production, selling or distribution, financing, and general administration. The functional manager in the formulation of policies for his division must have as a basis the factual information furnished by the records relating to that division. In the execution of those policies, records must be kept so that their results may be determined and relative efficiencies set forth. The records of a business must, therefore, give information with regard to two basic conditions, namely, the financial health of the business and its operating efficiency.

Double entry bookkeeping, in accordance with which modern business records are kept, was developed to provide information with regard to these two basic factors. The financial health of any business rests largely on the CAPITAL used in the business and the way in which it is managed. The purpose of the accounting record is, therefore, to set forth this factor of capital investment and the uses to which it is put. The system of records is based on what is known as the Proprietorship Equation,  $\text{Assets} = \text{Liabilities} + \text{Proprietorship}$ . This equation may be looked upon as a technical definition of the proprietary investment in a business, that is the amount of owner's capital invested and used in the business. The financial position of any business immediately after the original investment of CASH may be expressed in equation form as  $\text{Cash (Assets)} = \text{Owner's Capital (Proprietorship)}$ . With any transaction thereafter brought about by an exchange of cash for other ASSETS, or for the settlement of liabilities incurred, or for the payment of operating expenses, there is a change in the financial position of the business. Bookkeeping records these changes as they occur. The system of bookkeeping, based on the proprietorship equation, is called the Double Entry System and is always in equation, that is, in balance, when proper record has been made.

The record under double entry bookkeeping is made in accordance with the proprietorship equation, expressed in the form,  $\text{Assets} = \text{Liabilities} + \text{Proprietorship}$ . For the purpose of detailed record each of these three fundamental classes of items is broken down into as many detailed class records as may be necessary to provide the management with the necessary information concerning the kinds of assets, liabilities, and proprietorship. The record of each of these items is termed "an account" and has been developed technically for the purpose of recording the changes in each particular item. These changes bring about either an increase or a decrease in the item. The change in one item is always off-set by an equal change of an opposite character in one or more other items. Thus an equality is always maintained. These changes are recorded in accordance with the general principles of

debit and credit. An entry made to the left-hand side of an account is termed a Debit Entry. An entry made to the right-hand side of any account is termed a Credit Entry. Thus an entry made to the debit side of an asset account has the effect of increasing the asset. This entry may be off-set by a credit entry in some other asset account, in a liability account, or in a proprietorship account. A credit entry in an asset account has the effect of decreasing the asset, and is always off-set by corresponding debit entry in some other asset account, in a liability account, or in a proprietorship account. The principles in accordance with which debit and credit entries are made may, therefore, be expressed in summary form by the following schedule:

Dr	Cr
1. Increase of assets	a. Decrease of assets
2. Decrease of liabilities	b. Increase of liabilities
3. Decrease of proprietorship	c. Increase of proprietorship

Every transaction is thus recorded so as to show the cause and effect of the transaction. It is by means of this method that the books of account are constantly maintained in balance between their debits and credits. For the purpose of detailed record, under assets are such account titles as cash, notes receivable, accounts receivable, merchandise, investments, furniture and fixtures, machinery and tools, buildings, land, goodwill, patents and similar titles. Under liabilities such account titles appear as notes payable, accounts payable, mortgages payable, bonds payable and the like. Under the proprietorship group are two classes of items: that invested originally in the business and carried under the title owner's capital, or capital stock (in the case of a corporation); and temporary proprietorship, representing those changes brought about day by day by the receipt of income and the payment of operating expenses. Each of these items in turn may be subdivided. Under income may appear such items as sales income, commission income, interest income and professional fees. Under expenses may appear such items as manufacturing expense, selling expense, general administrative expense, financial management expense, under each of which may in turn be shown such items as salaries, supplies, rent, insurance and depreciation. In large business organizations the account titles are set up in great detail because of the need for detailed information to be furnished to the various operating executives.

The basic books of record in any accounting system operated by double-entry are a journal and a ledger. The ledger is the book in which the detailed accounts referred to above are kept in accordance with the principles of debit and credit. This book is, therefore, a classified record, the information being gathered under the classified heads indicated by the account titles. No transaction is recorded in any one place in its entirety because each transaction usually affects two or more accounts in which the record of it will be found. The journal is a book of record in

which each transaction is recorded chronologically, just as it occurs. Its record is in the nature of a diary of events. The journal is the book of first entry, that is, the book in which the formal record of the business transaction is first made. The ledger is a book of second entry in that the transaction first recorded in the journal is then transferred, or posted, to the proper accounts in the ledger. In practice the journal may be broken down into several parts for the purpose of recording in each journal transactions of a particular kind. Thus in the sales journal record is made of all sales as they occur, in the purchase journal, record is made of all merchandise or other purchases. The cash receipts journal records the receipt of cash, and the cash disbursements journal the cash expenditures. In the general journal are recorded all those transactions for which no special journals have been provided. It is, therefore, a miscellaneous or general journal. Ledgers also are sometimes sub-divided. We may have a customer's ledger in which are found only the accounts with customers, a creditor's ledger in which appear the accounts of creditors, and a general ledger in which all other accounts appear.

At the close of each fiscal period when it is desired to secure summarized information with regard to the financial and operating condition of a business, the greatly detailed accounts carried in the ledger are summarized, or condensed, and set up in two formal statements known as the **BALANCE SHEET** and the **STATEMENT OF PROFIT AND LOSS**. Preliminary to this work of summarization and report making it is considered necessary to prove the accuracy of the current record on the books. This proof constitutes the field of **AUDITING**.

The final function of accounting relates to the interpretation of the accounting reports. The reading of the balance sheet in order to determine the exact financial condition of the business, and the reading or interpretation of the profit and loss statement to determine the operating condition of the business as to its profit and loss results constitute one of the highest services of the accounting department. It is a function which usually is allotted to the head accounting officer, namely the **COMPTROLLER**.

The development of a system of records and reports suitable for a particular business comprises the work of systematization or system-building. This is also a basic function of accounting.

R. B. K.

**ACCOUNT PAYABLE**, a title used on the balance sheet to indicate the liability to creditors, the record of which is carried in open or running account on the ledger.

**ACCOUNT RECEIVABLE**, an asset title used on the balance sheet to indicate the claim against a debtor carried on open account. It is the reciprocal of **ACCOUNT PAYABLE**.

**ACCRETION**, a mode of acquisition to territory, borrowed mainly from the Roman Law, by which the territory of a country is increased and its boundaries extended by means of the certain, but nevertheless

gradual and imperceptible operation of the forces of nature, such as the slow change in a river course which forms a boundary, or the adding of sand to a seashore, or the formation of islands adjacent to the coast of a state. The land or territory so imperceptibly added becomes a part of the territory of the benefiting state, and is lost to the state suffering the damage. When there is a sudden change in the course of a river, where land is added suddenly through the action of water, i.e., where there has been an act of avulsion, the rights of the states as regards territory and boundaries, remain unchanged.

**ACCRINGTON**, a municipal borough of Lancashire, England, lying in the valley of the Hindburn, about 20 mi. north of Manchester. It is a town of modern construction except for the 18th century church. Extensive cotton mills and coal mines are located here in addition to chemical and print works. Pop. 1921, 44,975; 1931, 42,973.

**ACCRUAL**, an accounting term used to indicate at a given time the amount of expense incurred or income earned since the date of its last entry on the books. Wages and salaries, for example, are not usually paid at the close of each day as earned, but at convenient intervals, such as weekly or monthly. It is customary to record them on the books of account at the time of payment. If the end of the fiscal period falls between the times of payment, the amount of wages accrued since the last payment must be recorded if the books are to reflect the correct amount of such expense applicable to the current period. Similarly, in accordance with business custom, some kinds of income are received, not day by day as earned, but periodically. Interest on **BOND** investments is received usually every six months. At the close of a given fiscal period the amount accrued since the date of last receipt must be booked so that the records may reflect the correct income for the period. Books are sometimes closed and operating results determined on a cash basis, i.e., without considering the expense and income accrued at the end of the period. The accrual method of **ACCOUNTING** is the term used to distinguish such method from the cash method.

R. B. K.

**ACCUMULATOR**, an apparatus for storing energy to be utilized in work at another time or place. Accumulators of importance include **STEAM ACCUMULATORS**, engine receivers, compressed air, oil pressure and hydraulic accumulators and **STORAGE CELLS**. Engine receivers store the exhaust steam from the high-pressure cylinder of **STEAM ENGINE** and hold it until the low-pressure cylinder is ready to take it. They are used when the exhaust steam of the high-pressure cylinder cannot pass continuously to the low-pressure cylinder or when the low-pressure cylinder requires the admission of steam at the time the high-pressure one is not exhausting. **COMPRESSED AIR** accumulators are an essential part of air compressing apparatus since it is impractical to utilize the air as it is delivered from the compressor. Oil pressure accumulators are used to store oil under pressure with

an equalizing cushion of air. They are used to operate various mechanisms in hydraulic power plants. Hydraulic accumulators are used to accumulate high pressure of water for the operation of powerful presses for hot and cold forming and extruding of metals and other materials. These accumulators are, essentially, strongly constructed tanks connected to the exhaust of the compressor. The storage battery, or electrical accumulator, is different from other accumulators in that it changes the nature of the energy it receives and stores it as chemical energy. *See also* AIR COMPRESSORS.

**ACENAPHTHENE**, a hydrocarbon,  $C_{12}H_{10}$ , belonging to the aromatic series of organic substances and appearing in the form of white crystals. It occurs in COAL TAR, but can be made synthetically from the closely related NAPHTHALENE. It is used as an intermediate substance in the dye industry. *See also* DYES, SYNTHETIC.

**ACETALDEHYDE**, a colorless, mobile liquid, formula  $CH_3CHO$ . It has a suffocating odor, is soluble in water and common organic solvents, boils at  $20.2^\circ C$ , and has a density of 0.7834. Acetaldehyde is prepared commercially by: (1) oxidizing ethyl alcohol, or (2) by circulating acetylene through a suspension of mercury sulphate in dilute sulphuric acid. It is then "scrubbed" out of the gas with cold water and refined by distillation. It is industrially important as an intermediate in the manufacture of ACETIC ACID, ETHYL ACETATE, CROTONALDEHYDE and ethyl lactate. Acetaldehyde is commonly known as aldehyde.

BIBLIOGRAPHY.—T. C. Hilditch, *Catalytic Processes in Applied Chemistry*, 1929.

**ACETALS**, compounds formed by the condensation of ALDEHYDES and compounds containing a hydroxyl radical. Among them are: *Methylal*,  $CH_2(OCH_3)_2$ , condensed from formaldehyde and methanol, boiling at  $44^\circ C$ , which is used as a soporific; and *Acetal*,  $CH_3CH(OC_2H_5)_2$ , from acetaldehyde and ethanol, which boils at  $102.2^\circ C$ . Some of the more complex acetals have been prepared by absorbing acetylene in compounds having a hydroxyl radical and containing a small quantity of mercury salt.

BIBLIOGRAPHY.—Hill and Hilbert, *Jour. Am. Chem. Soc.*, 1923.

**ACETAMIDE**, an organic chemical substance belonging to, and the best known example of, the AMIDES. Its chemical formula is  $CH_3CONH_2$ , and it may be prepared from the ammonium salt of ACETIC ACID which, upon heating, decomposes into water and acetamide. It appears in the form of white crystals, which readily absorb moisture from the atmosphere.

**ACETANILIDE**, a drug and dye intermediate, known also as acetaminobenzene,  $C_6H_5NH-CO-CH_3$ . It is prepared by the interaction of acetic acid and aniline. It is a colorless crystalline powder, of which one part by weight will dissolve in about 190 parts of cold water. It is more soluble in hot water, from which it crystallizes in colorless, tasteless tablets which melt at  $114^\circ C$ .

It was first introduced in medicine under the name Antifebrine because of its antipyretic action. Its chief use is to relieve headaches, neuralgic pains and fever, and is a common ingredient in many "patent medicine" headache remedies. In excessive doses it is a cardiac depressant; for this reason and because of its habit-forming property, its indiscriminate use by the public is dangerous, and the law requires its presence must be declared on the label of patent medicines.

**ACETATES**, the salts or esters of acetic acid. Inorganic Acetates are prepared by dissolving metallic oxides, hydroxides or carbonates in ACETIC ACID, or by decomposing aqueous lead or calcium acetates with a metallic salt. *Aluminum acetate* is unstable, readily forming basic salts. It is used in dyeing and printing textiles. *Calcium acetate* is used for preparing ACETIC ACID, ACETONE and as a mordant in dyeing. *Lead acetate*, or "sugar of lead," readily forms basic salts, and is used for pigments, dyeing, medicine, and as an insecticide. *Sodium acetate* is used in the manufacture of acetic anhydride and dyes, in dyeing, and in meat preservation. *Ferrous acetate* is used as a mordant; *basic copper acetate* or VERDIGRIS, as a PIGMENT. For organic acetates *see under their names*: AMYL, BUTYL, CELLULOSE, ETHYL, METHYL, and VINYL ACETATES.

BIBLIOGRAPHY.—T. E. Thorpe, *Dictionary of Applied Chemistry*, 1927.

**ACETATE SILK**. *See* CELLULOSE ACETATE.

**ACETIC ACID**, the active principle of VINEGAR, a colorless liquid, having specific gravity of 1.055, and boiling at  $118^\circ C$ . It solidifies at  $16.7^\circ C$  as white crystals, or glacial acetic acid. It is soluble in water, alcohol, ether and many organic and inorganic substances. Its vapor has a pungent odor and burns with a bluish flame. It is stable at relatively high temperatures and even the most powerful oxidizing agents attack it with difficulty. Chlorine attacks it, forming the chloroacetic acids. The souring of wine is due to the formation of acetic acid. It is found in nature in the form of its salts and esters and among the decomposition products of inorganic compounds. The chemical formula of acetic acid is  $CH_3COOH$ .

Acetic acid is prepared commercially by the dry distillation of wood in iron retorts (*see* WOOD DISTILLATION). The aqueous distillate from this operation, called *pyroligneous acid*, contains acetic acid, which is neutralized with lime and evaporated to dryness. The product, gray lime, is heated to remove impurities and then distilled with a mineral acid. The crude product so obtained is purified by FRACTIONATION. Newer processes remove the acid from the pyroligneous acid directly by EXTRACTION. Some acetic acid is also prepared commercially by oxidizing alcohol at elevated temperatures in the presence of catalysts.

One of the most important methods of manufacture in this country is the oxidation of synthetic ACETALDEHYDE by passing air through liquid ALDEHYDE in the presence of a catalyst such as manganese acetate.

It is the basis of the preparation of acetic anhydride and has been used for the direct preparation of



**ACETONE.** It is also largely used for the manufacture of organic and inorganic **ACETATES** and many acetylated products. Acetic acid is used in the dye industry and in the manufacture of fine chemicals, as, for example, **ACETPHENETIDINE**, **ACETYL-SALICYLIC ACID**, and **ACETANILIDE**. K. G. B.; R. N. C.

**BIBLIOGRAPHY.**—T. E. Thorpe, *Dictionary of Applied Chemistry*, 1927, T. P. Hilditch, *Catalytic Processes in Applied Chemistry*, 1929.

**ACETIC ETHER.** See **ETHYL ACETATE**.

**ACETO-ACETIC COMPOUNDS.** See **ETHYL ACETO-ACETATE**.

**ACETONE** or **DIMETHYL KETONE**, a limpid, mobile, hygroscopic liquid, having an agreeable odor and a peppermint-like taste. It is miscible in all proportions with water, ethyl alcohol, gasoline, benzol and many other organic liquids. It possesses the property of a coupling agent, in that the addition of acetone enables certain non-miscible solvents to become miscible. Acetone is an excellent solvent for various resin gums, acetylene, cellulose acetate, cellulose nitrate, many oils and other organic compounds. Some of its more important physical properties are: boiling point,  $56.5^{\circ}\text{C}$ ; melting point,  $-94.9^{\circ}\text{C}$ ; flash point,  $1.8^{\circ}\text{C}$ ; critical temperature,  $235^{\circ}\text{C}$ .

The oldest method of commercially producing acetone is the destructive distillation of calcium acetate. However, acetone to-day is chiefly produced by other processes. When rice, meal or other carbohydrates are fermented by certain organisms, normal butyl alcohol and acetone are the chief products. Acetone is also produced by passing a mixture of ethyl alcohol or acetylene and water over catalysts at elevated temperatures and by the catalytic dehydrogenation or oxidation of isopropyl alcohol. (See also **WOOD DISTILLATION**.)

Acetone is used as an acetylene solvent in high pressure cylinders. It is used in the manufacture of cordite, is an excellent solvent for cellulose acetate, and finds use in the manufacture of acetate silk, lacquers and films. It is used in the dry cleaning industry and is an important ingredient of paint and varnish removers. (See **CELLULOID**; **CUPRAMMONIUM SILK**; **LACQUERS**.)

Acetone is the raw material for the manufacture of other chemicals. It can be condensed to diacetone alcohol, an excellent solvent, which, by dehydration, is converted into mesityl oxide, also an excellent solvent. Acetone is used in the manufacture of chloroform. Various synthetic resins may be prepared by combining acetone with other organic products, such as formaldehyde and phenol. C. L. G.

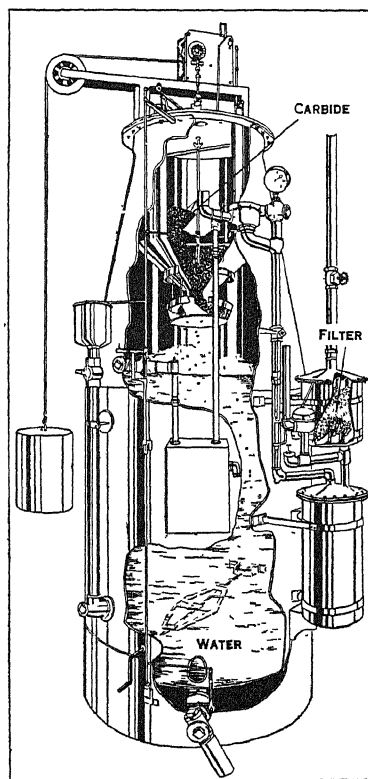
**ACETOPHENONE**, an organic chemical compound ( $\text{C}_6\text{H}_5\text{CO.CH}_3$ ) of the general type of the **KETONES**, containing a methyl as well as a phenyl group. Acetophenone is a rather volatile, crystalline substance with a pleasant odor; used as a mild anesthetic and soporific. It occurs in small quantities in coal tar.

**ACETPHENETIDINE**, official name for monoacetyl-ethoxy-aniline,  $\text{CH}_3\text{CO. NH. C}_6\text{H}_4\text{O. C}_2\text{H}_5$ ,

was introduced under the proprietary name **Phenacetine**. It is similar in action in the body to **ACETANILIDE**, except it is a little slower, and therefore its use deserves similar caution.

**ACETYL CELLULOSE.** See **CELLULOSE ACETATE**.

**ACETYLENE**, an inflammable, colorless gas, having the formula  $\text{HC.CH}$ . It is more toxic than coal gas (see **GAS MANUFACTURE**), but less so than **CARBON MONOXIDE**, and it forms extremely explosive mixtures with air. Soluble in water and many organic solvents—particularly **ACETONE**—under pressure it can be



COURTESY AIR REDUCTION CO.

ACETYLENE GENERATOR

Carbide, dropped from top of generator into water, generates acetylene. Impurities in gas are removed by a filter

detonated by shock and heat. It is shipped dissolved in acetone. It burns in air with a smoky flame, but from special jets the flame is non-smoky and very luminous, and it is extensively used for illumination (see **ILLUMINATION, ARTIFICIAL**). In oxygen the flame is extremely hot and is used for welding and cutting metals (see **METAL CUTTING**). It is prepared commercially from water and **CALCIUM CARBIDE**, according to the chemical equation,  $\text{CaC}_2 + 2\text{H}_2\text{O} = \text{Ca(OH)}_2 + \text{C}_2\text{H}_2$ . During the reaction, the temperature is kept low, generally by dropping the carbide into a large excess of water. Owing to impurities in carbide, acetylene may contain small amounts of phosphine, hydrogen sulphide, ammonia, and traces of hydrogen, nitrogen and oxygen. The usual method



of purification, which removes the most serious impurities, is to pass the gas over chloride of lime, cuprous salts or chromic acid.

METHANE may be converted to acetylene by purely thermal treatment at 1,300°-3,000°C., or by passing it through an electric arc.

At 500°-600°C. acetylene polymerizes to BENZENE, and at higher temperatures decomposes to commercial acetylene black and hydrogen, liberating heat. It is highly unsaturated and so forms numerous addition products. This property is made use of in the chemical industry in the preparation of halogen derivatives, ACETALDEHYDE and VINYL ACETATE.

K. G. B.; R. N. C.

BIBLIOGRAPHY.—J. H. Vogel and A. Schulze, *Carbid und Acetylen*, 1924.

**ACETYL-SALICYLIC ACID**, the mono-acetic acid ester of salicylic acid, commonly known as Aspirin,  $C_6H_4O(CH_3CO)$ .  $(COOH)$  1:2; in small colorless, odorless crystals or needles or a white crystalline powder. It is one of the chief members of the salicyl compounds and is much used for the relief of headache, rheumatism, pain and coryza. It is not free from untoward secondary effects.

**ACETYL SILK.** See CELLULOSE ACETATE.

**ACHAEAN LEAGUE, THE**, an organization of Greek city states lasting from 280 B.C. until its destruction by Rome at the capture of Corinth in 146 B.C. It was originally organized, as a revival of a more ancient association, in opposition to the power of Macedonia. As Roman power, in alliance with the Aetolian League and Sparta, increased, the Achaean League swung to alliance with Macedonia. Its greatest days, about 251 B.C., were under the *strategus*, or commander, Aratus of Sicyon. The league then embraced most of the Peloponnesus and in alliance with Antigonus Doson, King of Macedonia, reduced Sparta. The league later fell into ruins under internal dissensions and the growing power of Rome. The league left internal affairs to the cities themselves. Foreign affairs were directed by an assembly composed of citizens from the constituent members of the league.

**ACHATES**, the loyal companion and friend of Aeneas in Virgil's AENEID. The phrase "*fidus Achates*" has become a synonym for a devoted friend. "He has chosen this fellow for his *fidus Achates*," Sir Walter Scott.

**ACHELOUS**, the largest river in Greece, rises in the Pindus mountains, flows south and along the boundary between Aetolia and Acarnania into the Ionian Sea. It is over 100 mi. long, but not navigable. Its original name was Thoas, meaning swift. There is a muddy deposit in the waters which, collecting at the mouth, has formed a number of islands called the Echinades. The god of this river was a great divinity throughout Greece.

**ACHERNAR** (*Alpha Eridani*), a star of the first magnitude and the most brilliant blue star in the sky. It is situated at the extreme southern end of the constellation ERIDANUS, from which fact it derives its

name *Achir-al-Nahr*, Arabic for "river's end." Its distance is probably 73 light years, its luminosity 240 times greater than that of the sun. See STAR: map.

**ACHERON**, the name of several rivers, the principal one being in Epirus, Greece. The name is best known, however, as applied to the river of the lower world in mythology. It signifies the river of woe, and its shores were frequented by the shades of the dead. CHARON ferried the souls of the departed across this river.

**ACHESON, EDWARD GOODRICH** (1856- ), American inventor, was born at Washington, Pa., Mar. 9, 1856. Acheson's inventions have had a wide influence on American industry. He introduced carborundum, silicon and Egyptianized clay and discovered a method of making graphite. In 1880-81 he was associated with THOMAS A. EDISON as that inventor's assistant. In 1908 he was awarded the Rumford medal of the American Academy of Arts and Sciences.

**ACHEULIAN CULTURE**, the most recent Lower PALAEOOLITHIC PERIOD of the Old Stone Age (See STONE AGE), well represented at Saint-Acheul near Amiens, northern France, which gives this stage its name. Breuil places it in the second Interglacial interval of the Pleistocene period. Implements of the Acheulian stage are of the same general type as those of the preceding CHELLEAN stage, but more skillfully and artistically made. The flint tools called *coups-de-poing*, held in the hand to deliver a blow, are not so thick at the butt as in the Chellean. They have more regular edges. Sometimes a wavy chipping gives the edge a screw outline. At later stages of the Acheulian triangular implements are common.

There are Acheulian sites in Belgium, France, Spain, Italy, Africa, southern England and a few in Germany and Poland. Stone implements recently found in Mongolia have been assigned to the Acheulian stage of culture. It is probable that man of the Neandertal type shaped the implements of the Acheulian stage. See ARCHAEOLOGY.

**ACHILLES**, greatest of the Homeric heroes, was the son of PELEUS, king of the Myrmidons in Thessaly, and of THETIS, a Nereid. Hoping to render him immortal, Thetis plunged her son into the river Styx, but held him by the ankles which remained vulnerable, whence the phrase, "heel of Achilles," is derived. In his sixth year Achilles fought with lions and bears and caught stags without dogs or nets. The Muse Calliope taught him to sing at banquets. When he was nine, Calchas declared that Troy could only be taken with his aid. His mother, fearing that he would die in war, disguised him as a maiden, but he was discovered and ULYSSES succeeded in enrolling him among the Greeks. He was educated in war by Phoenix and in healing by CHEIRON the Centaur. He set forth to the siege of Troy commanding 50 ships, and by his prowess destroyed 12 towns. Agamemnon, leader of the Greeks, demanded as a captive Briseis, who had been assigned to Achilles. Bitterly humiliated, Achilles sulked in his tent and declined

to take part in the war. Thetis persuaded Zeus to declare that until Achilles was reconciled the Greeks would not win. The dearest friend of Achilles was PATROCLUS who, failing to mollify the hero, wore his armor and was killed in battle. Overcome with grief, Achilles put on new armor prepared for him by HEPHAESTUS and threw himself into the fray, slaying HECTOR and securing victory. Also he killed an Amazon called Penthesileia and, while mourning over her beauty in death, he was ridiculed by Thersites, the most talkative of the Greeks. With a blow of



EDUCATION OF THE YOUNG ACHILLES  
From a painting on an archaic jar

the fist, Achilles slew the scoffer. There are various accounts of the hero's death. According to Homer, Achilles loved Polyxena, a daughter of PRIAM, king of Troy, who tempted him to join the Trojans. Unarmed, he went therefore into the Temple of Apollo at Thymbra and was assassinated by PARIS. Ulysses and AJAX rescued his body and Thetis awarded the armor to the bravest of the Greeks. Agamemnon gave the verdict in favor of Ulysses, which disappointment drove Ajax mad. Believing that the sheep of the Greek army were enemies, he slew them and filled his tent with their carcasses. In the morning Ajax recovered his senses, and was so filled with shame that he destroyed himself with a sword which Hector had given him as a present. In the lower world Achilles became a judge and was united with Medea or, according to other accounts, with IPHIGENEIA.

**ACHIN**, a residency in the northern part of Sumatra, Dutch East Indies. It covers a territory of 21,448 sq. mi., mostly mountain ranges averaging in height from 7,000 to 10,000 ft. Rice is the principal product of the province, but palm oil, copra and pepper are the chief exports. Other products include rubber, sugar-cane and various tropical fruits. The natives engage in fishing and do considerable silk-weaving. The capital is Kota-Raja, situated on the Achin River, near the sea. Other important towns are Oleh-le, Edi and Meulaboh. Pop. 1927, 803,000.

**ACHOMAWAI**, an American Indian tribe speaking a dialect of the Shasta stock. Their habitat was the drainage of the Pit River in northeastern California. Culturally they may be classed both with the northwestern and central Californian tribes, since they

possess elements of both. They were hunters of deer using the pit method, made the common twined basketry of northern California, wore poncho-like garments of buckskin, and lived in summer under a brush or mat shade, and in winter in bark houses built over a slight excavation. Their ceremonial life was meager.

**ACHROMATISM**. Without chromatic effects. See CHROMATIC ABERRATION.

**ACIDIMETRY**, the analyzing of a solution to determine the amount of acid in it. This may be accomplished by neutralizing acids with ALKALIS, the quantity of which is measured, and making the proper calculations (see CHEMISTRY, ANALYTICAL); in the case of an aqueous solution, by measuring the specific gravity with a hydrometer. See also ALKALIMETRY.

**ACIDOSIS**, a term in medicine applied to the presence of abnormally large amounts of acid in the body. Since there is an efficient chemical mechanism in the blood to maintain its proper reaction, great variations in its acidity do not occur or death would promptly result. Acidosis is rather, then, an expression of the action of this acid-reducing mechanism. The excess acid is eliminated through the urine, which becomes markedly acid, and certain compounds are produced for which specific tests may be performed. RESPIRATION is increased in order to eliminate more CARBON DIOXIDE, as this substance forms carbonic acid in the blood. In addition, the reserve alkali in the blood is utilized to neutralize the excess of acid. Either of these latter may be determined by laboratory tests. Acidosis may result from: (1) consumption of large amounts of acid in the food; or (2) formation of acid in the body from an abnormal chemical process in certain diseased conditions. The former situation may be met by reduction of pickles and meats and the addition of oranges or moderate amounts of soda to the diet. The latter condition, however, is not so easily cleared, for the disease producing it must be cured. As the diseases which it accompanies are diabetes and nephritis, the extent of this difficulty is evident. See also COMA; DIABETES MELLITUS; NEPHRITIS.

**ACID ROCKS**, those IGNEOUS ROCKS characterized by a high percentage of silica, usually over 66%. This is not all present as QUARTZ, but much of it occurs in combination; quartz, however, is usually present. The acid rocks tend to light colors. GRANITE, SYENITE, quartz-diorite and their fine-grained or felsitic equivalents, RHYOLITE, TRACHYTE and DACITE, are usually spoken of as acid rocks. See also BASIC ROCKS; PETROLOGY; FELSITE.

**ACIDS**, substances which yield HYDROGEN, but no other positive ions. In general, acids are characterized by sour taste, the ability to form SALTS by interaction with BASES, the ability to evolve hydrogen when subjected to the action of the more active METALS, and the ability to change the color of certain INDICATORS.

For specific acids, see HYDROCHLORIC ACID; NITRIC ACID; PHOSPHORIC ACID; SULPHURIC ACID, etc.

**ACID SALTS**, chemical compounds resulting from the partial neutralization of polybasic acids by bases, one or more ionizable hydrogens remaining unplaced by metals or other basic ions. Examples: ammonium bisulphate,  $\text{NH}_4\text{HSO}_4$ ; monosodium phosphate,  $\text{NaH}_2\text{PO}_4$ ; disodium phosphate,  $\text{Na}_2\text{HPO}_4$ . Acid salts should not be confused with neutral, or normal, salts, which, by reason of **HYDROLYSIS** give an acid reaction in aqueous solution, *e.g.*,  $\text{CuSO}_4$ . Conversely, sodium bicarbonate,  $\text{NaHCO}_3$ , an acid salt, gives a basic reaction in aqueous solution.

**ACKNOWLEDGMENT**, a formal declaration or admission made in writing before a person duly authorized to take it. The practice started in England, after the enactment of the statute of enrollment in 1536. The officer in charge of enrollments required acknowledgments. In the United States this idea took the form of recording conveyances which was followed by statutes providing for acknowledgments. The sufficiency of an acknowledgment is determined by the law of the place where the property is located.

**ACNE**, commonly known as pimples, a skin eruption occurring on the face as well as on the back and chest. In the mildest form it consists of comedones or blackheads. Usually these become infected and give rise to lesions varying all the way from small, tender inflammatory lumps to huge pus-filled abscesses of the skin. Acne is associated with an oily skin and often with dandruff of the scalp. Acne appears usually at the age of puberty. Its course is chronic and may show many temporary periods of spontaneous improvement. Eruptions often follow the partaking of excessive carbohydrates, alcoholic beverages, or highly seasoned foods. In girls they may be related to the menstrual periods. After a varying number of years, the process usually subsides permanently. Treatment should be commenced early in all cases, however, to prevent scarring. Constipation, if present, should be corrected and the foods mentioned above should be avoided. Excessive oiliness of the skin should be combated by the frequent use of soap and water. Blackheads should be squeezed out with a suitable instrument and abscesses should be opened and drained. Mild sulphur or resorcinol lotions may be used, X-rays in proper doses are beneficial. *See also* **LIGHT, ARTIFICIAL, IN TREATMENT OF DISEASE.**

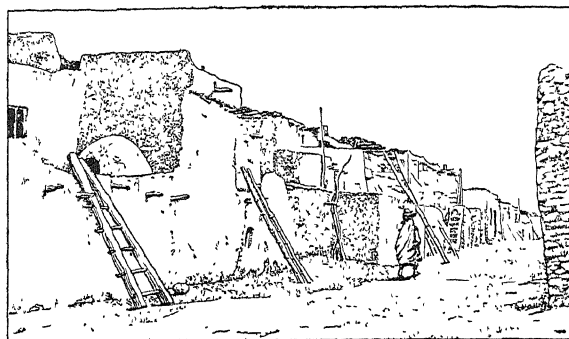
M. R. C.

**ACOEMETI**, a Greek word, signifying without sleep. It describes an order of eastern monks whose worship is continued without intermission, day and night.

**ACOLYTE**, usually a lay attendant at ritual services whether Roman, Anglican or Armenian. He is arrayed in simple vestments, and it is his duty to carry candlesticks, to light lamps, bring the elements for the Eucharist and generally assist the officiating priest. The derivation of the word is from the Greek *akolouthos*, follower.

**ACOMA**, the name applied to a Keresan speaking group as well as to the pueblo, or town, occupied by

them, situated in Valencia Co., N.M., about 60 miles west of the Rio Grande. The pueblo is built of three-storied adobe houses terraced back from the street in three rows. The Acoma have long been known, having been visited as early as 1540 by members of Coro-



STREET IN THE PUEBLO VILLAGE OF ACOMA, NEW MEXICO

nado's army. They are agriculturists, having irrigated their fields, which are worked by the men, since prehistoric times. The women still make a distinctive type of lustrous black pottery in many graceful forms.

**ACONCAGUA**, an extinct volcano in the southern Andes. With a height of 23,080 ft., it is the highest mountain in America. It was formerly assumed to stand in or on the border of Chile, in  $32^{\circ} 39'$  S. lat. and  $70^{\circ} 1'$  W. long. but is now included in Argentina in accordance with agreements between the Argentine and Chilean authorities. At this place the Andes run north and south in three great parallel ranges. But there are only two, the Tigre in the east and in the west the chain of the water-parting, to which Aconcagua belongs, but which lies about 4 mi. farther west. Aconcagua is thus shown to stand well within the Argentine frontier. Although visible on a clear day from the Pacific, it drains in the direction of the Atlantic, about 700 mi. away.

The volcano has been extinct for a long time and shows no trace of its terminal crater which stood one or more thousand feet above the present summit. Aconcagua ejected great quantities of ashes, scoria and lava at various points on the mountain slopes; and where streams issue from their mountain valleys they have usually built up extensive detrital fans. The town of Mendoza is built on one of these.

The summit of Aconcagua was first scaled by S. M. Vines of the FitzGerald expedition in 1897.

**ACONITE** (*Aconitum*), a group of handsome plants of the crowfoot family found widely in the northern hemisphere, known commonly also as monkshood or wolfsbane. The showy, usually blue or yellow flowers are borne in clusters on tall stalks, one of the sepals forming the characteristic helmet from which these plants gain the name monkshood. They make useful garden perennials, being easily grown in ordinary soil. The roots of *A. ferox* and *A. palmatum* yield the well-known bikh poisons of India. The European monkshood (*A. Napellus*), likewise very

poisonous, is of medicinal importance. Several wild aconites are found in the United States and Canada.



ACONITE  
*Aconite Napellus*

The powerful drug aconite, prepared from the roots of *A. Napellus*, is administered chiefly in the form of a tincture. It is used guardedly for reducing temperature, though its action is uncertain. In larger than medicinal doses it is highly poisonous.

**ACORN**, the characteristic fruit of oak trees composed of a nut set in a scaly cup. Both the nut and the cup of different species of oak vary greatly in size, color and form. Because of their usual bitter quality, the nuts of but few kinds of oaks are edible although they make excellent food for various animals, especially for fattening pigs. In some European countries an acorn meal is used in making bread. The Indians of California formerly used acorns extensively for food.

**ACORUS CALAMUS**, the classical and also the botanical name for the SWEET FLAG, a pleasantly scented plant of the arum family found widely throughout the north temperate zone.

**ACOSMISM**, a philosophical term parallel with ATHEISM, and signifying a belief that the cosmos has no independent existence apart from God Who is the only ultimate reality.

**ACOSTA, JOSÉ DE** (1539-c. 1600), Spanish historian and cosmographer who lived in Peru for a time and later returned to Spain where he became rector of the University of Salamanca. He wrote extensively and his *Historia natural y moral de las Indias* earned him the title of "Pliny of the New World." The value of his work lies in the fact that it gives an excellent description of the physical and moral characteristics of the Indians, as well as a description of the fauna, flora and climate of America. He wrote also a *Compendio historico del descubrimiento y colonizacion de la Nueva Granada*.

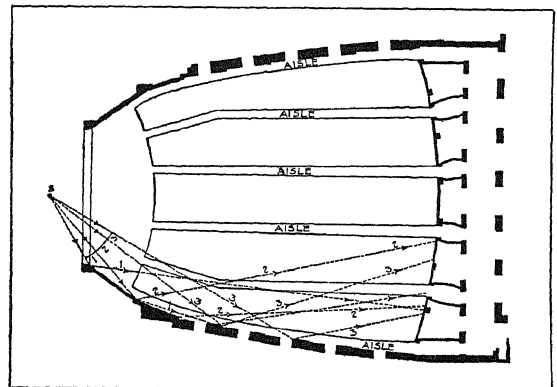
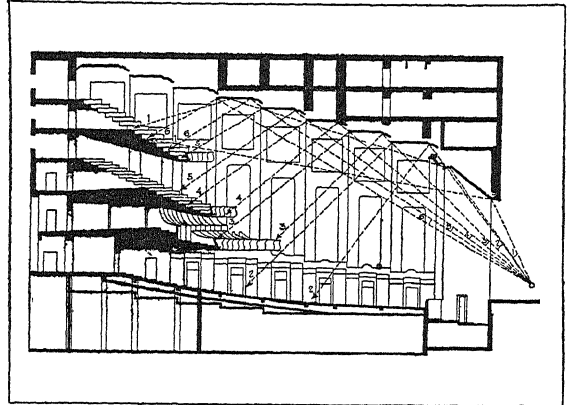
**ACOUSTICS.** See SOUND.

**ACOUSTICS OF BUILDINGS** comprises two distinct sets of problems, those relating to the behavior of SOUND in rooms and those concerned with the transmission of sound from room to room through walls, floors and ceilings. (See SOUND INSULATION.)

**Auditorium Acoustics** will be good if the sound in all parts of the room is sufficiently loud and if the rapidly moving elements of music and speech are clear and distinct and free from each other and from extraneous sounds. Acoustic conditions to fulfilling these two requirements are secured by proper design and interior treatment.

The obtaining of sufficient loudness becomes a problem only in large rooms. If the extreme distance

between the source of sound and any auditor is less than 100 ft., the direct sound of a good speaking voice can easily be heard and understood, provided the second requirement is met. In larger rooms, it is necessary to design the contours to provide reinforcement of the direct sound by useful reflections from certain parts of the walls and ceilings. In very large



COURTESY RIVERBANK LABORATORIES

PLAN AND SECTION OF THE CHICAGO CIVIC OPERA HOUSE SHOWING THE USEFUL REFLECTIONS OF SOUND FROM WALLS AND CEILING

rooms, that is, rooms with volumes of more than 1,000,000 cu. ft. and with seating capacities of more than 5,000, only a powerful voice can be heard in the most distant portions, and electrical amplification should be provided.

In order for reflected sound to be a help rather than a hindrance to good hearing, the reflected wave should not lag appreciably behind the direct wave. If the difference between the time of arrival of direct and reflected wave is as great as  $1/20$  sec., the ear will perceive the reflected sound as a repetition of the direct sound. Thus, as the velocity of sound is about 1,120 ft. per sec. at ordinary room temperature, the path of the sound by way of the reflecting surfaces should not exceed the direct distance from speaker to auditor by more than 56 ft. Speaking generally, this means that in very large rooms, reflections, to be useful, should be only from surfaces near either the speaker or the auditor. Reflections at large angles of incidence from surfaces that are not near either the auditor

or speaker may result in useful reinforcement. The illustration shows the reflections from the walls and ceiling of the Civic Opera House, Chicago. Here, due to the spread of the side walls from the stage, the reflected sound is directed to the rear, with only a small path difference between direct and reflected sound. In the section it appears that the stepped arrangement of the ceiling provides for ceiling reflections to the balconies rather than to the main floor.

**Echoes and Reverberation.** Sound received after reflection at a sufficient distance from the direct sound and with sufficient intensity to be distinguished as a separate sound is called an echo. A number of separately distinguishable echoes is spoken of as a multiple echo. If the original sound is prolonged, the resulting multiple echoes merge into each other, prolonging the sound in the room for an appreciable length of time. This prolongation is called reverberation. It is the source of most of the acoustical difficulties encountered in audience rooms. Discrete echoes occur only in large rooms, or in smaller rooms in which the sound is focused by reflection from an extended concave surface. Echoes are localized in certain regions. Reverberation may be observed in rooms of all sizes and is general throughout a room. Both echo and excessive reverberation tend to decrease the clarity and distinctness of music and speech.

**Prevention of Echo.** Echoes due to reflection from plane surfaces are not apt to be troublesome, with the possible exception of the echo experienced just back of the transepts in long, narrow churches of the Gothic type. Here, reflection from the extreme rear wall may be sufficiently strong and sufficiently delayed to cause much acoustical difficulty. Spherical domes, ceilings or ceiling vaults, with radii of curvature approximating the ceiling height, focus the reflected sound sharply on the audience, producing echoes which may be comparable in intensity with the intensity of the direct sound. The lining of such surfaces with highly absorbent material alleviates this difficulty but, in general, does not eliminate it. A safe working rule is to avoid extended curved shapes in walls or ceilings with centers of curvature in the neighborhood either of the stage or of any portion of the audience. In talking-motion-picture houses, the directional effect of the loud speakers frequently causes an annoying echo from a curved rear wall. It is possible that the seating plan centering at a point on the stage contributes to this effect.

**Control of Reverberation.** Sound, once set up within a closed space, will persist until it is dissipated through some absorptive process. The time during which the residual sound remains audible will depend upon its initial intensity, the total volume of air enclosed in the room, the total sound absorbing power of the room and, to a slight degree, the shape of the room. When the emanation of sound begins in a room, the average intensity gradually builds up to a final steady state at which the rate of emission of energy at the source just balances the rate at which it is absorbed at the boundaries. When the emana-

tion ceases, the intensity gradually decreases to the initial point of audibility. If the steady state is 1,000,000 times the intensity at the initial point, then the time required for the intensity to decrease from that of the steady state to that of initial audibility is given by the equation

$$T = \frac{0.05 V}{a}$$

where  $V$  is the total volume of the room in cu. ft. and  $a$  the total absorbing power. The absorbing power of a given material is the product of its area and the fraction of the energy which is absorbed when sound is incident upon that material. This fraction is called the absorption coefficient of the material. The total absorbing power of a room is the sum of the absorbing powers of all the surfaces and areas which are exposed to the sound in the room. The following table gives the absorption coefficients of a number of materials normally found in audience rooms.

Material	Coefficients (at 512 vibrations per sec.)	
Hard plaster on tile	}	0.015 to 0.025
Painted brick		
Stone		
Concrete		
Smooth plaster on metal or wood lath		0.035
Rough plaster on metal or wood lath		0.050
Wood sheathing ¼ in. thick		0.06 to 0.10
Pressed vegetable fiber boards, ½ in. thick		0.20 to 0.30
Heavy carpet		0.20 to 0.25
Hair felt ½ in. thick		0.30 to 0.35
“ “ 1 in. “		0.50 to 0.60
“ “ 2 in. “		0.75 to 0.80
Heavy curtains in folds		0.40 to 0.50
Wooden theater chairs		0.3
Upholstered seats (per seat)		2.0 to 3.0
Audience (per person)		3.7 to 4.3

Measurements of the reverberation periods of audience rooms that are acoustically good show that for rooms with volumes ranging from 100,000 to 1,000,000 cu. ft., the computed reverberation time should lie between one and two seconds. The following table gives the range of reverberation times for satisfactory hearing conditions for rooms of different volumes.

Volume (cubic feet)	Time (seconds)
10,000	0.9 to 1.1
50,000	1.15 to 1.35
100,000	1.35 to 1.50
200,000	1.50 to 1.65
400,000	1.65 to 1.80
600,000	1.80 to 1.90
800,000	1.90 to 2.00
1,000,000	2.00 to 2.05

As numerous highly absorbent materials are now available, it is quite possible to adjust the reverberation period to good hearing conditions in almost any auditorium in which the ratio of the volume to the seating capacity is not extremely great. P. E. S.

**ACQUISITION**, a term applied to the formal act of gaining legal title to territory. Such title may be legally acquired by discovery, followed by occupation and settlement; by **ACCRETION**, or the enhancement of land through the imperceptible action of water; by

**CESSION**, which is a peaceful form of purchase, ratified by treaty; by **CONQUEST**, which gives only an inchoate title during military occupation, and which must be confirmed by a treaty of peace unless the entire territory of a conquered opponent is acquired and its sovereignty consequently extinguished; and by prescription, which is the undisputed, long-continued possession of territory. Conversely, such title may be lost by the operation of physical forces, such as volcanic action, by cession, conquest, prescription and dereliction or abandonment.

**ACRE**, a unit of land measure comprising 160 sq. rods or 43,560 sq. ft. One square mile includes 640 acres and is known as a section; 36 sections, or an area six miles square, is a township in the United States. The equivalent of the acre in the **METRIC SYSTEM** is 4047 sq. meters.

**ACRE**, also known as St. Jean d'Acre, a town in Palestine, situated 12 mi. northeast of Haifa on a sand-blocked harbor of the same name. Acre has always been an important point in the communication between Europe and Asia, but it cannot compete with Haifa as a port. Conquered by Thutmosis III and Sethos I, it became the seat of a prince under the suzerainty of Egypt. Later it was subject to the Assyrians. The Egyptian Ptolemies gave the town the name Ptolemais and made it a strategic point for their control of Palestine. Taken by Antiochos the Great in 219 B.C., it long remained in the hands of his successors, the Seleucides. The Romans called Acre Colonia Ptolemais. St. Paul found Christians there when he arrived, and it later became the seat of a bishop. The town was conquered by the Arabs in 638; henceforth the Semitic name and character again came to the fore. When the Crusades began, the Christian commanders attempted to take possession of the city, but were unsuccessful until 1104, when Baldwin I conquered it. Saladin retook it 83 years later, but in 1191 Acre again fell into the hands of the Christians. The Teutonic Order was founded there in 1198 and was the bulwark of the Christians until its surrender in 1291. Under Egyptian and Turkish rule, it was still a landing place for Christian pilgrims. It became part of Palestine after the World War, being captured from the Turks by the British in Sept., 1918. Palestine is the center of the Bahai religion; it has a large mosque built in the 18th century; the people carry on trade in oil and grain along the coast. Pop. 1931, 7,893.

**ACRE, SIEGE OF.** See **CRUSADES**.

**ACRIDINE**, an organic chemical compound found in coal tar. It is related to **ANTHRACENE**, but contains a nitrogen atom in its molecule; it can be made from anthracene by oxidation and subsequent treatment with **AMMONIA**. It is used as an intermediary in the manufacture of dyes. See **DYES**, **SYNTHETIC**.

**ACROBATIC FLYING.** See **AIRPLANE MANEUVERS**.

**ACROBATICS**, a term applied to many difficult feats of personal strength, skill and agility, such as balancing on chairs or barrels, walking on a large

rolling ball, tumbling, vaulting and particularly to feats on a slack or tight rope. Modern circuses, like those of ancient Rome, always offer acrobatic displays of various sorts.

There have been many noted families of acrobats including, in the 19th century, the Chiarinis and Kolters; and famous individuals, as Farioso, Madame Saqui and Diavolo. Perhaps the best-known of all was the steel-nerved Blondin, who not only walked across the chasm of Niagara Falls on a tight rope, but also rolled a man across in a wheelbarrow and again carried another across on his shoulders. The Orient has been noted for its highly trained acrobats, and troupes of Japanese, Chinese and Arabians have at times toured the country with great success.

See Le Roux and Garnier, *Acrobats and Mountebanks*.

**ACROLEIN**, an acrid smelling, rather volatile liquid ( $C_2H_3CHO$ ), extremely irritating to the lungs and throat. Chemically, it is the aldehyde of **ALLYL ALCOHOL**, and is formed by the decomposition of **GLYCERINE** as in the overheating of fats and oils. The irritating odor from the wick of a candle just extinguished is produced by acrolein.

**ACROMEGALY**, a diseased condition probably due to over-activity of the anterior portion of the **PITUITARY GLAND**, one of the endocrine glands. Too active secretion of the anterior portion of this gland during childhood results in excessive growth of the skeleton, so that the individual becomes a giant. After a person has attained his full stature, oversecretion can no longer produce gigantism, but it still causes thickening of the bones, especially at their ends and over prominences. Accordingly, acromegaly is a condition of adult life. The head becomes larger, the nose thickens and widens, the jaws enlarge, especially the lower. The bones and soft parts of the hands and feet increase in thickness, giving the hands a spade-like appearance. A narrowing of the field of vision results from pressure of the enlarged pituitary gland on the optic nerve. When the disorder is due to a tumor of the pituitary body, operation and removal of the tumor may bring about a cure.

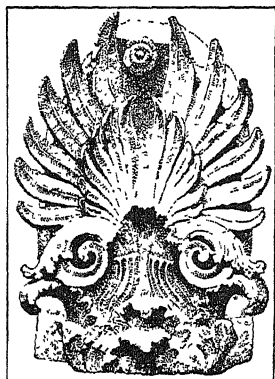
**ACROPOLIS**, in early historic times, the fortified citadel of a city; especially that of Athens which was the most famous, although portions of the cyclopean walls are all that remain of it. The Athenian Acropolis was the sacred ground reserved for the most important temples. On the west side was the Propylæa, originally the fortified gateway to the citadel, later an elaborate portal leading into the sacred enclosure. The new Propylæa, designed by Mnesicles, was begun in 437 B.C. and consisted of a Doric portico at each end with a covered passageway between which was divided into aisles by two rows of Ionic columns. On the Acropolis were the Parthenon and the Erechtheum, the little Ionic temple of Athena Nike, the colossal statue of Athena Promachos by Phidias, and many other statues, altars, and shrines.

**ACROSTIC.** See **CROSS-WORD PUZZLE**.

**ACROTERIUM**, the ornament decorating the summit and the outer corners of a pediment or classic



gable. Acroteria were of terra cotta or marble, and often of large size. Early examples are decorated with rosettes or anthemions; later, gryphons and



ACROTERIUM



COURTESY M M OF ART  
ACROTERIUM FROM  
THE WEST FRONT  
OF THE PARTHE-  
NON

figures were occasionally used. Acroteria were usual in Greek and Etruscan work, but were little used in Roman buildings.

**ACTA DIURNA**, the daily news sheets in Roman imperial times. They were posted in some public place and on them appeared official decrees and appointments, a record of the day's events of the city, and word from distant parts of the empire. At the close of the day they were removed and filed. The official use of the acta was instituted by Caesar as a modification of the older public billboard, the album.

**ACTAEON**, the son of Aristaeus and Autonoe, trained as a hunter by a centaur called CHEIRON. According to Ovid, Actaeon saw the goddess ARTEMIS bathing on Mount Cithaeron and was changed into a stag, which was pursued and torn to pieces by 50 dogs.

**ACTING**. The oldest of all the arts, because the most elemental, that of acting is the most mutable, the most evanescent, the least scientific, the most rebellious to rule, the most personal form of all. From the days of Thespis to Hollywood it has experienced a bewildering, kaleidoscopic and incessant change. In its essence it is an individual reaction to emotions prescribed by the dramatist, not only to the actor but also to those of each unit of the audience for whom it is displayed. It traces its origin to savage ceremonial dances and its classic beginnings to the Dionysiac festival. The player of Greece and Rome faced greater restrictions than his fellow of the present time. Mounted upon his buskin and *cothurnus* and balancing upon his head the unwieldy mask with its wig, he found little opportunity given him for freedom of action or nuance of vocal expression. His entire face was hidden and his words were megaphoned to open-air audiences numbering ten to twenty thousand through the mouth-opening of his huge mask. Acting for the Greeks was mainly a matter of vociferous elocution. Even the antic clowning in the plays of ARISTOPHANES was comic because of its grotesque mask and the shouted humor of the lines.

The beginnings of the art of acting reach far back into the records of the ancient world, that of China

being presumably as old as that of Greece. Not until the Middle Ages, however, did it become a recognizable craft in England, France, Germany, Spain, Scandinavia and modern Italy.

The first exponents of the medieval theater were of the Church who chanted and recited their religious plays in Latin. Then the laity organized associations and guilds of actors, often in the universities, who presented FARCES and mysteries (*see MYSTERY PLAYS*) in the vulgar tongue. These were the ancestors of the actors of to-day. In the 16th century acting had become not only an art but a paid profession. From Richard Burbage, the original performer of *Hamlet* and *Lear*, sprang a line of English actors of brilliant achievement—Betterton, Quin, Garrick, Kemble, Mrs. Siddons, Edmund Kean, Macready, Henry Irving, Ellen Terry and a host of others.

France, since the foundation of "The House of Molière" which placed dramatic art on the footing of a national institution, has by conservation and tradition brought acting to a high state of technical perfection. Among its exponents of classic tragedy were LeKain, Talma, Mlle. Mars, Rachel and Mounet Sully. Molière, Lemaître, Got and Constant Coquelin were celebrated in comedy, and Sarah Bernhardt in romantic rôles.

Italy numbers Adelaide Ristori, Rossi, Tomasso Salvini, Novelli and Eleanora Duse in its roster of illustrious players. Scandinavia preserves two centuries of tradition and devotion to the art of acting, and Poland sent its most gifted daughter, Helena Modjeska, to reveal to Europe and America the splendid qualities of its theater. Since the days of Lope de Vega Spain has been notable for fine players, standing single among whom is Maria Guerrero. In Germany, August Wilhelm Iffland and Ludwig Devrient held supremacy at the end of the 18th and in the early 19th centuries. Bogumil Dawison, Possart, Barnay and Agnes Sorma later reigned as favorites. It was, however, in the skillful team-work of the companies of the Duke of Saxe-Meiningen and afterwards that of Reinhardt that the most perfect exposition of German acting was conserved. From the latter was graduated Alexander Moissi.

Though of later birth than that of other countries, the art of Russia is remarkable, reaching its highest expression in the acting of the Moscow Art Theater Company, an ideal organization.

The United States has been rich in dramatic talent. Many actors were foreign born and, like the Elder Booth, Charles Fechter, Fanny Janauschek and Helena Modjeska, became permanent residents after careers in their native countries.

Cooper, Forrest, Charlotte Cushman, Clara Morris, John Owens, William Warren, E. L. Davenport, Joseph Jefferson, the Drews, William Florence, John McCullough, Richard Mansfield, Mary Anderson and Lawrence Barrett are but some of the names eminent in American stage history; beyond them all stands Edwin Booth. Maude Adams, Ethel Barrymore and Katherine Cornell still carry on the American tradition.

# ACTING



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## STAGE FAVORITES OF ENGLAND, FRANCE AND AMERICA

1. Edwin Forrest as Spartacus in *The Gladiator*.
2. Charles J. Kean as Louis XI.
3. Mary Anderson as Ophelia.
4. Edwin Booth as Richelieu in Bulwer Lytton's play of the same name.
5. Henry Irving as Shylock.
6. Joseph Jefferson as Rip Van Winkle.
7. Ellen Terry as Portia in *The Merchant of Venice*.
8. Sarah Bernhardt as Adrienne in *Adrienne Lecouvreur*, one of the plays of which she was the author.
9. Otis Skinner as the Beggar in Edward Knobloch's *Kismet*.





The manner of acting has changed materially since the days of the ponderous Kemble and the stately Siddons. The stage is no longer either Georgian or Victorian, nor does it reverberate to the melodious thunder of Forrest or Cushman. Elaborate romanticism and classic formalism have been replaced by suggestion and colloquialism. To-day there are fewer "stars" than in the '70s and '80s but a higher degree of general excellence in ensemble distinguishes the English-speaking stage. Versatility, however, has grown noticeably less, actors become "types" expressing their own individuality and the play producer selects that which fits the requirements of his cast. The part is not brought to the actor; the actor is brought to the part.

To attempt to reduce acting to a scientific basis would be well-nigh impossible. There are as many conflicting methods of portrayal as there are temperaments of its expositors. No hard and fast rules have ever stood the test of time.

One of the most notable discussions of its principles was between the English HENRY IRVING and the French CONSTANT COQUELIN. The former found the ideal form of acting to lie in a blending of the character he enacts, an immersion of his individuality into the stream of feeling, be it gaiety or sorrow. He must literally live the part to be perfect. The more logical Coquelin viewed his art from an entirely opposite standpoint. To him loss of one's complete detachment meant loss of control of the effects he seeks to produce upon his audience. Giving way to emotion led to over-expression and absence of proportion. The truth lies between these two theories. The actor must feel the sensitiveness, the sympathy and the elation of acting, but he must be of a dual personality, the instrument plus the player whose alert ear instantly detects a false note.

Shakespeare's *Hamlet* laid down as sound a rule as any other when advising the player who had lost himself in his acting, "in the very torrent, tempest and . . . whirlwind of passion, you must acquire and beget a temperance that may give it smoothness." George Henry Lewes terms this "the paradox of acting." Bernard Shaw calls it "willed rapture."

In the art of the cinema, although derived from the theater proper, a change of method becomes necessary to achieve the finest effects. It is essentially a mechanical process projected by artificial means. The stage demands expression, the talking film repression.

The real art of an actor is a personal thing—a conception of emotion, character and situation unfolded to audiences which become the collaborators of its creation. Like Othello's jealousy it "grows by what it feeds on" and perfects itself by its failures.

O. S.

**BIBLIOGRAPHY.**—Brander Matthews, *On Acting*, 1914; George H. Lewes, *On Actors and the Art of Acting*.

**ACTINIC RAYS**, a term applied to radiation which is effective in producing chemical or other changes, particularly those changes which occur in connection with PHOTOGRAPHY. The term formerly

was used in reference to the upper portion of the visible spectrum (*see* LINE SPECTRUM) and the near ultra-violet, but such a restriction is now largely without basis for, in the field of photography, for example, it has been possible to produce photographic plates sensitive in the red, and even in the infra-red, region of the spectrum. It is probable that the particular frequency of LIGHT required to produce a certain chemical change is related to the natural FREQUENCY of some oscillating portion of the atom or molecule involved. As a general proposition, it may be stated that the higher the frequency the more active, or actinic, is the ray. This is consistent with the QUANTUM THEORY, according to which the energy in a quantum of light is  $hf$ , where  $h$  is Planck's constant and  $f$  is the frequency of the light. Any chemical or other change produced by radiation (*see* RADIATION, THEORY OF) takes place on the basis of the action of one quantum, and, in order that action shall take place, it is necessary that the quantum possess an amount of energy as large as, or larger than, that required to bring about the change. P. I. W.

**ACTINIUM**, a series of radioactive elements (*see* RADIOACTIVITY) which is a descendant of uranium. There are nine known elements and one hypothetical element in the series. The element actinium is the second of the series and it, together with actinium-B and actinium-C emits beta rays (*see* BETA PARTICLES), the others emitting alpha rays (*see* ALPHA PARTICLES). The average life of actinium is 28.8 years; its atomic number is 89. Actinium gives off *actinon*, a gas which resembles thorium and radon.

**ACTINOMETER.** An instrument which measures the chemical or actinic effects of light, usually by some photochemical reaction. A photographic actinometer, sometimes called an exposure-meter, usually consists of a cylindrical, light-tight box containing a roll of sensitized paper which can be moved so that a new section comes directly behind a small aperture when the light at a given location is to be measured. The paper darkens progressively, and the actinic power (*see* ACTINIC RAYS) of the light is determined by the time required to match a standard shade placed beside the aperture. Knowing this, the correct photographic exposure time is obtained from a chart on the instrument. Originally, the name actinometer was applied to an instrument which measured the heating effect of the sun's rays, which is now done with a periheliometer. *See also* PHOTOGRAPHY.

**ACTINOMYCOSIS**, a chronic, suppurative disease produced by a branching fungus. It occurs in cattle and occasionally in persons tending cattle. In man it occurs in three forms, depending upon whether it attacks the jaw and neck, intestines, or lungs. In each of these locations it results in the formation of long-standing abscesses. The facial form, which is the most common, can usually be cured by drainage of the abscesses. The intestinal and pulmonary forms are more fatal, but respond in some degree to the use of iodides. In cattle the disease forms large hard swellings, whence the common name, lump-jaw.

**ACTINON.** See ACTINIUM.

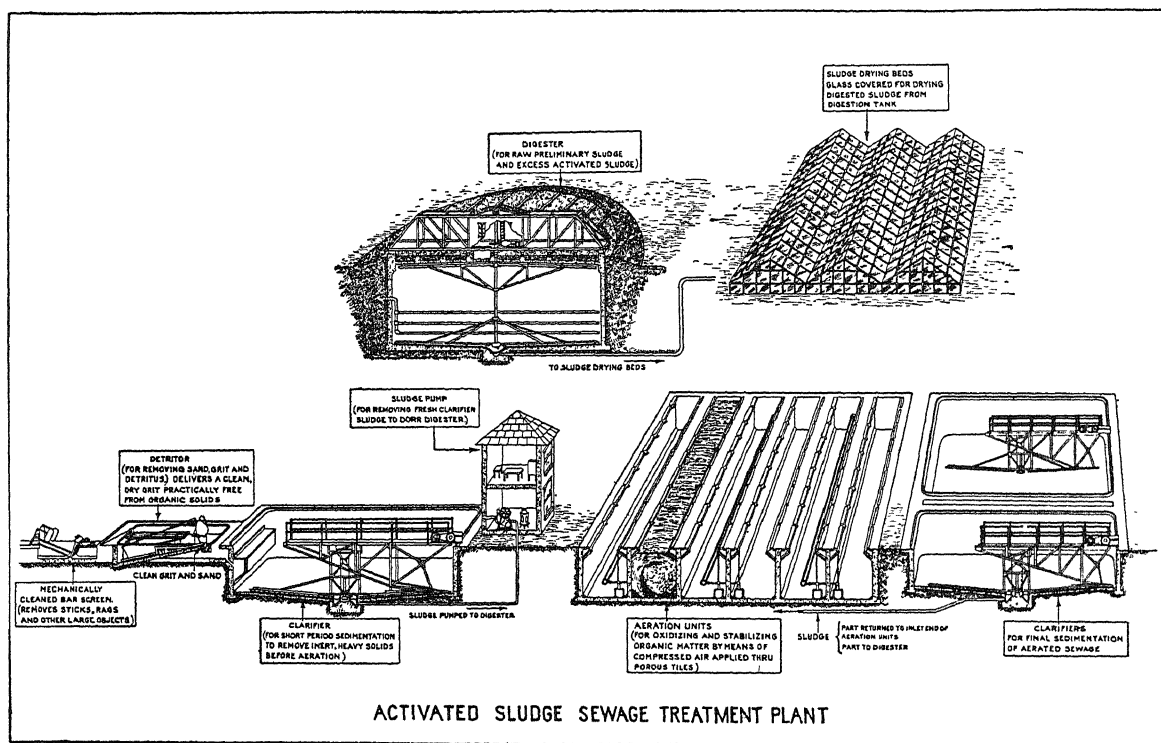
**ACTION,** a formal proceeding in a court of justice whereby the moving litigant or litigants seek the enforcement or protection of a right or the redress or prevention of a wrong or, in case of penal actions, the punishment of an offence. Criminal actions, or prosecutions, are brought by the government to punish or prevent public wrongs or crimes. Real actions, now obsolete almost everywhere, were highly technical proceedings to recover freehold estates in land. They have been superseded by simple statutory proceedings. Personal actions are brought to recover a debt or damages.

**ACTIUM,** an ancient town and promontory on the western coast of Greece, in the northern part of

and caused Nicopolis to be built at the site of his army's original camp in honor of his victory.

**ACTIVATED CARBON.** See CARBON, ACTIVATED.

**ACTIVATED SLUDGE PROCESS** of SEWAGE TREATMENT, consists of introducing air into sewage, generally by blowing it through porous tiles in the bottom of a detention basin, thus, oxidizing and removing the fine solid matter by permitting a biochemical process (see SEWAGE OXIDATION) to take place. It was developed technically about 1912. In this process, newly filled basins are "seeded" with a small amount of already activated sludge which forms a nucleus of a bacterial culture in and on which the removal and purification of the fresh sewage takes



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DIAGRAMMATIC FLOW SHEET SHOWING DETAILS OF AN ACTIVATED SLUDGE SEWAGE TREATMENT PLANT

Acarnania, at the mouth of the Gulf of Ambracia. Corinthian colonists were the first settlers and erected a temple to Apollo Actius. The Acarnanians had taken it by the 3rd century B.C. It is celebrated for the battle fought between Marcus Antonius and Octavius in 31 B.C. Antonius had held the power in the east and Octavius in the west, but the struggle for supremacy had been long. Finally the two fleets met outside the gulf at Actium. Antony had the heavier boats equipped with artillery, while Octavius had lighter craft better suited to quick maneuvers. Cleopatra joined Antony with her fleet. In the midst of the fight, however, they both deserted the scene of action and their ships were burned. Octavius, afterward Augustus, rebuilt the temple of Apollo at Actium, renewed the games known as the *Actia*

place. Upon the completion of the process the activated sludge is removed from the liquid by sedimentation.

The process is probably the most effective yet developed for treating sewage, but is expensive because of the high cost of aeration. Recently means have been developed whereby the aeration is produced at or near the surface of the liquid by means of mechanical agitation and spraying. By this method it is claimed that the cost of operation is much reduced. The effluent from this process is usually quite clear and almost odorless.

W. W. H.

**ACTIVE LIST,** the list of officers liable to be called upon for active duty in contradistinction to the retired list. See RETIREMENT, NAVY AND MARINE CORPS.

**ACTIVE SERVICE, U.S. NAVY**, service performed by officers and enlisted men of the Navy who are on the Active List, or by retired officers and retired enlisted men who are ordered to active duty by their own consent. In wartime, however, or in an emergency, both officers and men may be ordered to active duty at the discretion of the Secretary of the Navy.

**ACTON, JOHN EMERICH EDWARD DALBERG ACTON, BARON** (1834-1902), English historian, was born at Naples, Italy, Jan. 10, 1834. His father, Sir Richard Acton, held a diplomatic post at this city and his grandfather had been a Neapolitan admiral. The Actons were a Roman Catholic family, long naturalized in Naples. Baron Acton studied at Oscott College, Birmingham, under Nicholas Wiseman. He continued his studies at Edinburgh, and then became a pupil of the celebrated historian Dollinger in Munich. In 1859 Baron Acton succeeded Newman as editor of *The Rambler*, a Catholic periodical whose ultra liberal tone offended ecclesiastical authorities, and it was discontinued in 1864. In the meantime, as member of parliament, Acton had become intimate with W. E. GLADSTONE, whom he admired and by whom he was raised to the peerage in 1869. In 1895 Lord Rosebery offered him the Cambridge professorship of modern history. His inaugural lecture made a tremendous impression at the University and at once established his influence on historical studies. Baron Acton conceived and partly organized the *Cambridge Modern History*. He wrote but little, and what he did publish was in the form of articles contributed to various magazines. After his death these articles were published as *Lectures on Modern History*, 1906, and *History of Freedom and other Essays*, 1907. Although the output was not great, the high quality of his work, notable for the critical insight which he shows, ranks him among the leading historians of his generation. He died at Tegernsee, Bavaria, June 19, 1902.

**ACTOR**, a performer who entertains the public by portraying with the semblance of reality a rôle learned; or by exhibiting special talents, such as singing, dancing, acrobatics, ventriloquism, juggling. The actor on the legitimate stage has by tradition reached the highest distinction, but the motion picture actor has an opportunity for wider popularity. Similar talents are required of both, but the motion picture actor must above all "screen" well. Dramatic instinct, personality and imagination are the actor's equipment. A resonant voice and good diction, for which special training is desirable, are essential. Training in music, singing and dancing, in fencing and in foreign languages are valuable to any actor, and particularly so to the musical comedy actor, who must have grace and versatility. Character actors are those best fitted to play certain rôles better than others, such as villain, juvenile, adventuress, and are usually fitted with certain distinguishing physical characteristics to do so. Comedians are those gifted with the ability to make the audience laugh; their brand of humor may range from the tragi-comic to the burlesque. The stock

actor must be able to memorize parts quickly, preparing one play while playing another, which is strenuous but valuable dramatic training. The vaudeville actor prepares a single act exhibiting his particular talents and plays it from theater to theater until popularity wanes. See also DANCER. R. PL.

**ACTS OF THE APOSTLES**, the fifth book of the New Testament, is a continuation of the GOSPEL OF ST. LUKE, and is professedly by the same author. In brief, it may be described as a history of early Christianity from the ascension of Jesus to the last days of the Apostle Paul in Rome. In the view of early scholars it was written between 66 and 70 A.D.; but later students date it after the destruction of Jerusalem, some even as late as 90 A.D. Four groups of passages, namely, Chapters 16:10-17; 20:5-15; 21:1-18; and 27-28:16, are written from the standpoint of an eye-witness, and are usually referred to as the "We" sections. The intimacy of the connections and the undesigned coincidences between the book and the Pauline epistles are shown in Paley's *Horae Paulinae*.

The usual title of the Acts is inexact, for the author deals with the acts and labors of but two of the apostles, Peter and Paul, especially the latter, and illustrates through his work the emancipation of Christianity from its Jewish origin and environment. Some scholars read in this emphasis an effort by the author to please Rome and Roman Christians. The first converts are Roman officers; Romans help and protect Paul; and instead of closing with Paul's martyrdom at Rome, the book ends by saying that he lived there, preaching, "none forbidding him." The stories of Peter include his defense before the High Priest, Caiaphas, the episode with Ananias the liar, the miraculous release from prison, the rebuke of Simon Magus, the raising of Dorcas from the dead, and Peter's vision of so-called "impure food."

The Paul narratives begin with his persecution of the Christians and his conversion on the road to Damascus, and, from Chapter 13 to the end, relate his experiences on his three missionary journeys through Syria, Cilicia, Pamphylia, Galatia, Lydia, Phrygia, Cappadocia, Thracia, Macedonia, Thessalia, Greece and Cyprus, and his voyage via Crete to Rome. The first journey is described in Chapters 13:4 to 15:35; the second in 15:36 to 18:22, while the last is described in 18:23 to 21:17, when Paul returns to Jerusalem, is mobbed, claims to be a Roman citizen, is tried, appeals to the Emperor, sails for Italy, is shipwrecked near Malta, and at last arrives at Rome, where the author leaves him preaching.

**ACTUARY**, a person employed by an insurance company to calculate the risks and premiums in selling various types of insurance. In life insurance he coordinates the mortality tables with medical information and other data, prepares the premium rate and calculates the loan value of a policy. Practical experience in insurance and extensive mathematical knowledge are the requirements for a successful career as actuary for an insurance company whether its special field be life, accident, fire, marine, or theft insurance.

**ADA**, a city in southern Oklahoma, the county seat of Pontotoc Co., situated 85 mi. southeast of Oklahoma City. It is served by three railroads. The fertile surrounding country produces cotton, grain, peanuts, sweet potatoes and live stock. Rich deposits of oil, lead, zinc, asphalt and other minerals are mined in this region. Ada is an industrial center, manufacturing chiefly cotton products, cement, glass and bricks, and having grain elevators and feed mills. The retail trade in 1929 amounted to \$8,053,278. The State Teachers College is located here. Ada was incorporated in 1901. Pop. 1920, 8,012; 1930, 11,261.

**ADAD**, an Assyrian and Babylonian storm god, identified with Ramman and Rimmon, the latter of whom is mentioned in the Old Testament as the chief deity of Damascus. Scholars believe that Ramman was the name in use in Babylonia; whereas Adad, probably imported from the Aramaic, was the name used in Assyria. There were two prevailing conceptions of the god in Babylonia: the one a beneficent god of the seasonal rains who brought fertility to the land; the other, the sender of the tempest with its floods, lightning and famine. In the hymns this latter aspect usually predominates.

**ADAGIO**, an Italian term in musical EXPRESSION, indicating very slow tempo, somewhat slower than *ANDANTE* and only a little faster than *LARGO*.

**ADAM**, the Hebrew word for Man, indicating by derivation not an individual but a species. It is akin to *adamah*, meaning soil, and according to Mesopotamian tradition, Man was clay, mixed with the blood of Bel. (See *BAAL; BEL AND THE DRAGON*.) In Genesis 1 to 3, a composite narrative, we find Man created on the sixth day (1:26), and the verse suggests a racial emergence. A more precise narrative tells of a man formed out of dust, into whose nostrils God breathed the breath of life.

Set in the *GARDEN OF EDEN*, Adam found names for all creatures. While in a deep sleep, Adam lost a rib, out of which God built up a woman, "bone of my bones and flesh of my flesh." Adam and the woman were naked and unashamed. Of all trees might they eat, save "the tree of the knowledge of good and evil." The serpent, representing *SATAN*, tempted the woman who took an apple from the forbidden tree, and, with Adam, ate of it. Conscious then of their nakedness, they hid themselves, making aprons of fig leaves, but were discovered by God, who cursed the serpent and declared war between the devil and the seed of the woman. Instead of their former comradeship, Adam was to have rule over the woman. Agriculture was to encounter thorns and thistles, and there was to be death. "Dust thou art and to dust shalt thou return." Adam called the woman *EVE*, meaning Life, because she was to be "the mother of all living." God gave them skins for clothing and drove them out of Eden; and the former paradise was guarded by "cherubims and a flaming sword which turned every way, to keep the way of the tree of life." Apart from the genealogies in Genesis, Adam is not again mentioned in the Old Testament.

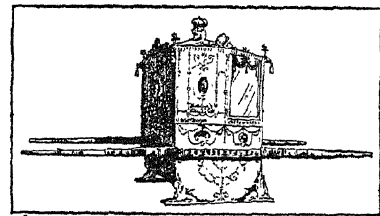
Paul regarded him (Romans 5:14) as the anti-type of Christ. The first Adam fell into sin; the second Adam rose out of sin into grace.

This majestic conception of human destiny as a drama in which man overcomes the evil within and around him, was developed by St. AUGUSTINE into a systematic evangel, which, at the REFORMATION, was proclaimed by MARTIN LUTHER and expressed in the clear hard terms of French logic by JOHN CALVIN. Milton adopted it as the theme of his epics *Paradise Lost* and *Paradise Regained*, and Newman, in his *Dream of Gerontius*, offers us the stanza:

O loving wisdom of Our God,  
When all was sin and shame,  
A second Adam to the fight  
And to the rescue came.

On the other hand, the fall of man from a state of innocence must be considered in relation to the message of science set forth in articles like *ANTHROPOLOGY* and *EVOLUTION*, which suggest the upward progress of the race from primitive conditions. *ARCHAEOLOGY*, by demonstrating that many gains of civilization have been lost at a later date, for instance, Angkor, Babylon, Carthage and Roman Britain, has furnished a measure of historical vindication of the underlying idea of the ancient traditions of which the Hebrews made use.

**ADAM, ROBERT** (1728-92), British architect and furniture designer, the older and better known of four brothers, John, Robert, James and William, was born July 3, 1728 in Kircaldy, Scotland, the son of a prominent Scottish architect. Educated at Edinburgh University, he studied in Italy where the recently rediscovered ruins of Pompeii and Herculaneum had a great influence on his work. James also studied in



SEDAN CHAIR. ROBERT ADAM, DESIGNER

Rome and later worked with Robert in grouping unimportant London houses so as to give them the appearance of a single, imposing edifice.

The work of the Adam brothers, particularly James and Robert, was characterized by a lightness and delicacy. They incorporated festoons, wreaths, and fan ornaments in their decoration, in marked contrast to the massiveness characteristic of the period. They naturally undertook the design of furniture in order to obtain the effects desired for their interiors. They are particularly famous for their mantelpieces, doors, and sideboards. Buildings by the Adams brothers are the Adelphi, London—a vast terrace on arches containing warehouses and supporting streets and houses;

Lansdowne House; Kedleston Hall and Luton House. In Edinburgh, Register House and the main block of University buildings testify to their skill. Robert Adam died in London, Mar. 3, 1792.

**ADAM-AND-EVE**, a name sometimes applied to the *PUTTYROOT*, a perennial North American orchid in which the stem rises from a corm produced from the one of the previous season by an offset, giving the appearance of two partly united corms.

**ADAMANT**, or *adamas*, a Greek word used by ancient authors to designate various hard substances, as hard armor metal and such minerals as rock crystal (*QUARTZ*), *CORUNDUM* and *DIAMOND*. Later the meaning was restricted to the diamond, the hardest substance known, and *adamas* finally was supplanted by the word diamond. Particularly brilliant surfaces as of the diamond are now described as having an adamantine luster; corundum is occasionally called adamantine spar. Otherwise, the term has dropped out of mineralogical use. By confusion with *adamare*, to have attraction for, *adamas* was applied also to the *LODESTONE* in Roman times.

**ADAM BEDE**, the first long novel of *GEORGE ELIOT*; published 1859. Adam Bede, a character supposedly modeled on that of the author's father, is a sturdy English countryman of the type George Eliot drew so admirably. He is in love with Hetty, a vain, hard-hearted dairy-maid, who with "the young squire," Captain Arthur Donnithorne, deceives the faithful Adam. The climax is reached when Hetty, being tried for the murder of her illegitimate child, is saved from the gallows by the last-minute intervention of Donnithorne. The disillusioned Adam is united, at the end, with Dinah Morris.

**ADAMITES**, early heretics in Africa who believed that they had returned to Adam's original innocence.

**ADAMNAN, ST.** (c. 625-704), an Irish writer and abbot, was born at Raphoe in Donegal, about 625, and educated at the monastery of Clonard. In 679 St. Adamnan was elected abbot of the Columban brotherhood at Iona. While visiting King Alfred of Northumbria he became converted to the Roman calendar for the date of Easter and to the wearing of the Roman tonsure. These changes he tried to introduce at Iona, but without success. St. Adamnan's most important writing was the *Biography of St. Columba*, *Vita Sancti Columbae*, a work in which is preserved much of the early history of the Scotch-Irish Church. He wrote also in Latin a description of the travels of Arculf in Palestine, called *On the Holy Places*, a valuable guide to the Holy Land. He died at Iona in 704. His day is kept on Sept. 6.

**ADAM OF BREMEN** (c. 1045-c. 1076), an ecclesiastical historian and geographer. He was canon and *magister scholarum* at Bremen from 1068 to the time of his death. He wrote a history of the archbishopric of Hamburg covering the period 788-1072; a work of great historic value, in which is found the first mention of Vinland as well as the sources for the history of the diocese of Gardar, Greenland, founded about 1122.

**ADAMS, ABIGAIL SMITH** (1744-1818), wife of President *JOHN ADAMS*, was born at Weymouth, Mass., Nov. 11, 1744. In childhood she developed a talent for letter-writing, which became her lifelong recreation. She was married in 1764, and lived first in Braintree, Mass., where four children, John Quincy, Thomas, Charles and Abigail were born. The family lived in London three years after the Revolution, returning to America in 1787. Two published collections of her letters reveal her prominence and influence in political and social affairs. She died at Quincy, Mass., Oct. 28, 1818.

**ADAMS, CHARLES FRANCIS** (1807-86), American diplomat, born at Boston, Mass., on Aug. 18, 1807, the son of *JOHN QUINCY ADAMS*. Study at an English boarding school, at the Boston Latin School and at Harvard College ended in his graduation from Harvard at 18 years of age. In 1828-29 he studied law with Daniel Webster, and began to practice in Jan. 1829. For the next decade he occupied himself with writing for the *North American Review* and the *Boston Advocate*. In 1840 he was sent to the Massachusetts legislature, and spent three years in the lower house and two in the upper. He was elected to Congress in 1858, and was appointed minister to Great Britain in 1861. Remaining in this position until 1868, he was successful in ensuring the neutrality of England during the Civil War. In the arbitration of the *ALABAMA CLAIMS* as United States commissioner, he helped greatly in effecting a successful settlement. He was considered for President by the Liberal Republicans in 1872, but gave way to *HORACE GREELEY*. Adams then turned to writing and the editing of his father's diary. He retired from public life in 1874, and died at Boston on Nov. 21, 1886. He prepared for publication *Letters of Abigail Adams*, 1840; *Works of John Adams*, 1850-56; *Memoirs of John Quincy Adams*, 1874-77.

**ADAMS, CHARLES FRANCIS, 2ND** (1835-1915), American historian, railroad official and soldier, grandson of *JOHN QUINCY ADAMS*, was born at Boston, Mass., May 27, 1835. In 1856 he was graduated at Harvard, and two years later was admitted to the Massachusetts bar. He served as a cavalry officer during the Civil War, rising from first lieutenant to brigadier general. After the war he entered the railroad industry, in which he soon gained prominence as an authority, and in 1869 was appointed Massachusetts railroad commissioner. In 1871 appeared his *Chapters of Erie* (with Henry Adams), an exposé of contemporary railroad evils which, together with other writings of his, largely influenced later federal regulations of transportation. From 1884 to 1890 he was president of the Union Pacific Railroad. Adams was elected president of the Massachusetts Historical Society, 1895, and for 20 years thereafter contributed numerous historical essays to its *Proceedings*. He became president of the American Historical Association in 1901. His biography of *Charles Francis Adams* (American Statesmen

series) is a valuable study of the diplomatic history of his father's time, displaying an independence and clarity of thought characteristic of most of Adams's works. Among his other writings are *Three Episodes of Massachusetts History*; *Richard Henry Dana*; and an *Autobiography*. Although never a candidate for public office, Adams always maintained an active interest in public affairs. As chairman of the Massachusetts Park Commission he helped plan the Boston park system, and he was an overseer of Harvard for twenty-four years after 1882. He died at Washington, D.C., Mar. 20, 1915.

**ADAMS, FRANKLIN PIERCE** (1881- ), American journalist and author, best known as "F.P.A.," was born at Chicago, Ill., Nov. 15, 1881. He wrote for the *Chicago Journal*, 1903-04, the *New York Mail*, 1904-13, the *New York Tribune*, 1914-21, and from 1922 to 1930 conducted a column, *The Conning Tower*, in the *New York World*, subsequently continued in the *New York Herald-Tribune*. Adams is the author of *Tobogganing on Parnassus*, 1910, *In Other Words, By and Large, Weights and Measures, Overset, So There, So Much Velvet*, 1924, *Half a Loaf*, 1927, *Christopher Columbus*, 1931, and other works.

**ADAMS, GEORGE BURTON** (1851-1925), American historian, born at Fairfield, Vt., on June 3, 1851. After attending grammar schools in the locality, he was tutored by his father and then entered Beloit College, where he received his master's degree in 1876. Obtaining his B.D. at Yale College in the next year, he was at Drury College as professor of history during 1877-88. With his Ph.D. in history from Leipzig in 1886 he went to Yale in 1888 as professor of history, remaining there until his death. During his years at Yale he was a leader in the field of education in the United States, and drew large numbers of graduate students to the college by his scholarship and leadership. He was an editor of the *American Historical Review* in 1895-1913, and served as president of the American Historical Association in 1907-08. His published works include: *Civilization during the Middle Ages*, 1894; *Medieval Civilization*, 1883; *Growth of the French Nation*, 1896; *Rise of Imperial Federalism*, 1896; *Constitutional History of England*, 1920; *Origin of the English Constitution*, 1920; and *Council and Courts in Anglo-Norman England*, 1926 (posthumously). He died at New Haven on May 26, 1925.

**ADAMS, HENRY** (1838-1918), American historian, son of CHARLES FRANCIS ADAMS, one of the most illustrious members of the famous family, was born at Boston, Feb. 16, 1838. He was graduated from Harvard University in 1858, and continued his education in Europe. From 1870 to 1877 he taught medieval history at Harvard and edited *The North American Review*. Afterward he lived in Washington, studied and wrote. His *History of the United States from 1801 to 1817*, which was published in 1889-90 and republished in nine volumes in 1909, became the standard work on the administrations of

Jefferson and Madison. His conclusions, based upon wide and meticulous research, were presented with all the skill of a great literary craftsman. It was followed in 1891 by *Historical Essays*. In 1904 Adams printed privately *Mont-St-Michel and Chartres*, of which a general edition was published in 1913, and in 1907 *The Education of Henry Adams*. The latter volume, an autobiography of rare charm, is permeated with his dynamic theory of the historical process and his sense of futility as he seeks to discover the realities of the past. He died at Washington, D.C., Mar. 27, 1918.

**ADAMS, HENRY CARTER** (1851-1921), American educator and political economist, was born at Davenport, Iowa, Dec. 31, 1851. He was director of transportation of the 11th United States Census and was statistician of the Interstate Commerce Commission from 1887-1911. Previously he had been political economy lecturer at Cornell. He was the author of *Outline of Lectures on Political Economy, State in Relation to Industrial Taxation, Taxation in the United States, Public Debts, Science of Finance and Economics and Jurisprudence*. Adams died on Aug. 11, 1921.

**ADAMS, HERBERT** (1858- ), American sculptor, was born at West Concord, Vt., Jan. 28, 1858. He is known principally for his beautiful busts of women done in the early Italian Renaissance style in polychrome or tinted marble. Strongly reminiscent of Luca della Robbia, such as *Miss Pond*, the *Rabbi's Daughter*, and *Primavera*. Other works are his fountain at Fitchburg, Mass., two bronze doors for the Congressional Library, and a memorial to Jonathan Edwards, at Northampton, Mass.

**ADAMS, HERBERT BAXTER** (1850-1901), American historian and educator, was born at Shutesbury, Mass., Apr. 16, 1850. He was graduated from Amherst in 1872, and studied political science, history and economics at Gottingen, Berlin and Heidelberg. From 1876 until his death he was connected with Johns Hopkins University in Baltimore, where he was professor of American and institutional history. In his seminars in history and the historical method many Americans received that thorough training which Adams himself had experienced in German universities. In 1884 he was one of the founders of the American Historical Association, of which he later became president. He wrote *Methods of Historical Study* and *The Life and Writings of Jared Sparks*. He died at Amherst, Mass., July 30, 1901.

**ADAMS, JAMES TRUSLOW** (1878- ), American historian, was born at Brooklyn, N.Y., Oct. 18, 1878. He was graduated from Yale University and was a member of the New York Stock Exchange until 1912. In 1919 he helped to prepare data for the World War Peace Conference. His *Founding of New England* won the 1922 Pulitzer Prize for the best book on American history. Among Adams's other works are *Provincial Society*, 1927, *Jeffersonian Principles*, 1928, and *The Epic of America*, 1931.



**ADAMS, JOHN** (1735-1826), second President of the United States, was born at Braintree, Mass., Oct. 30, 1735, son of John Adams, a farmer, whose ancestors had come from England to America about 1636, and Susanna Boylston Adams. Graduating from Harvard in 1755, he first thought of entering the ministry, then decided for the law, and after studying with James Putnam was admitted to the bar in 1758. In the popular resentment against the Stamp Act, in 1765, he became a recognized leader, and in 1768 the British Government offered him, practically as a bribe to buy his services, the lucrative post of Advocate-General in the Court of Admiralty, which he refused. In 1771 he was elected a member of the Massachusetts General Court, and in 1774 became a delegate to the Continental Congress.

At the Congress Adams was one of the most active and influential of the leaders. He was one of the first to urge the inevitability of independence from England, and he was largely responsible for Washington's appointment as Commander-in-Chief in June, 1775. On June 7, 1776, he seconded, and led the debates in favor of, the resolution of Richard Henry Lee, which resulted in the Declaration of Independence a month later. He became chairman of the Board of War and Ordnance, and served on the Committee on Foreign Relations and in other important capacities.

He was on a brief mission to France in 1778 and returned in 1779 to take charge of the negotiations for the treaty of peace with Great Britain. He distrusted Vergennes, the French Foreign Minister, disagreed with his own colleague, Benjamin Franklin, and often persisting in his own position and demands, negotiated alone with the British. In 1780 he was sent as Minister to Holland, where he obtained that nation's recognition of American independence. After the conclusion of peace he was appointed, in 1785, the first American Minister to the Court of St. James, a difficult position which he filled until 1788, when he requested to be allowed to resign. In 1789 he was elected as first Vice-President of the United States, and in 1796 he succeeded Washington—defeating Thomas Jefferson by three electoral votes—as President.

As Vice-President he had quarreled with Alexander Hamilton, and he began his term as President under the cloud of that powerful leader's hostility. Always an independent, as distinct from a party man, he antagonized the Federalists. The Jefferson faction opposed him. Although he was an exceedingly able statesman as well as a man of devoted patriotism and passionate integrity, and his term was one of conspicuous usefulness, it was occupied throughout with quarrels and petty opposition. When war threatened with the French Directory, and was being fomented by the strong Hamilton faction, Adams appointed first a Minister and then a Commission of negotiation, on his own initiative and without consulting anyone. He not only acted within his rights, but saved the international situation, but he aroused such

a storm of indignation and hostility in his own Cabinet and party that he lost then and there the reelection for the presidency, and his political star never rose again. He retired, very unpopular, at the conclusion of his term, to his Massachusetts home, and as time went on he drew obvious interest and satisfaction from watching the career of his son John Quincy Adams. He wrote some public papers, and grew into part friendship with Thomas Jefferson with whom he corresponded voluminously. Long before the end of his life public opinion toward him changed, and he was accorded some of the appreciation which, owed always to his fine mind, character, and achievement, had been withheld because of his undeniably difficult temperament.

John Adams married, on Oct. 25, 1764, Abigail Smith, daughter of Rev. William Smith, of Weymouth, herself a remarkable personality, who ably aided her husband's career. They had four children, John Quincy, who became President of the United States in 1825; Thomas, Charles, and Abigail. John Adams died at Quincy, Mass., July 4, 1826.

**BIBLIOGRAPHY.**—See his own writings and letters, and the biography by his grandson, Charles Francis Adams; also John T. Morse, Jr., *John Adams* (1885); C. Warren, *John Adams and the American Constitution* (1927); and James Truslow Adams, *The Adams Family* (1930).

**ADAMS, SIR JOHN** (1857- ), English educator, was born at Glasgow, Scotland, July 2, 1857. After graduating with honors from the University of Glasgow, he taught in various schools and colleges. He visited Canada on an Educational Commission in 1902, and from that year until 1922 he was principal of London Day Training College, University of London, serving at the same time as professor of education at the university. He became professor emeritus in the latter year. His publications include *Primer on Teaching*, *The New Teaching*, and *Errors in School: Their Cause and Treatment*. He was knighted in 1925.

**ADAMS, JOHN COUCH** (1819-92), English astronomer, born near Launceston, Cornwall, June 5, 1819. He was professor of astronomy, director of the observatory at Cambridge, and with U. J. J. LE VERRIER discovered the planet Neptune. Adams died at Cambridge, Jan. 21, 1892.

**ADAMS, JOHN QUINCY** (1767-1848), sixth President of the United States, was born at Braintree, now Quincy, Mass., July 11, 1767. He was the eldest son of JOHN ADAMS, second president, and ABIGAIL QUINCY SMITH ADAMS, both of English descent. He had received little schooling when his father was appointed commissioner to France in 1777. Adams accompanied his father to Paris the next year, and in 1779 entered a Latin school at Amsterdam, where his father had been sent as minister to the United Provinces. The year following the son entered the University of Leyden, where he began to keep his celebrated diary. European schooling, combined with the intellectual brilliance of his father, had advanced Adams's education beyond his years, and at 14 he



qualified as secretary to Francis Dana, American minister to Russia. He returned to Paris in 1782, and in a secretarial capacity aided his father, Benjamin Franklin and Arthur Lee, the American commissioners, in negotiating the treaty concluding the Revolutionary War. He declined to remain abroad when his father was appointed first minister to England, 1785, and returned home to enter Harvard College. He was graduated in 1787, and in 1790 was admitted to the bar.

Adams opened an office in Boston. He wrote a series of papers upholding the neutral policy of the administration toward England and France. Washington, in need of a minister to the Netherlands, promptly appointed Adams to The Hague in 1794. During an official visit to England in 1797, Adams married Louisa Catherine Johnson (d. 1852), daughter of Joshua Johnson of Maryland. In 1796 Washington selected Adams as minister at Lisbon, but the next year, following the inauguration of his father, John Adams, the latter countermanded the appointment, sending his son to Berlin instead. Adams negotiated a commercial treaty with Prussia, 1799, and returned to the United States in 1801. The year following he was elected to the Massachusetts Senate, and in 1803 became a member of the U.S. Senate. In the upper house, where he remained until 1808, Adams proved himself a skillful and fearless debater, but his disinclination to ally himself definitely with either Federalists or Republicans forced him into the minority ranks. His fiery addresses, however, won a certain influence in the Senate, and were largely responsible for the passage of Jefferson's Embargo Bill, as an alternative to war with England.

Resigning his seat in the midst of the clamor against him and his father, Adams retired to private life and became professor of rhetoric at Harvard. In 1809 President Madison appointed him minister to Russia. He went to London in 1814 to assist in negotiating the Treaty of Ghent. Two years later President Monroe appointed him secretary of state, for which post Adams's wide experience in European courts and chancellories had given him unusual qualifications. He remained in this office for eight years, and was closely associated with the cession of the Floridas by Spain and the formulation of the Monroe Doctrine. He supported the Missouri Compromise, although he was categorically opposed to slavery. In the presidential election of 1824 he received the second largest number of electoral votes; in the absence of a majority, the election was thrown into the House of Representatives. Clay, a candidate, cast his influence against Jackson for Adams, and the latter was elected on the first ballot, taking office in March 1825.

Adams began his administration with a program providing internal improvements, but he immediately encountered the opposition of Jacksonian Democrats. His appointment of the eminent Clay as secretary of state was the signal for a political outcry in which charges of corruption were thrown at the President.

The 1826 mid-term elections increased the opposition represented in Congress. His lack of political skill made him enemies, and his indifference to party patronage brought him the hostility of his own supporters. He was defeated in 1828 by Jackson, and left office charging the nation with ingratitude.

Adams expected to retire to Quincy and devote himself to writing history and biography. Instead he was elected to Congress in 1831, and the 17 years until his death represent the most notable period of his whole career. As a Massachusetts representative, Adams staunchly fought the extension of slavery, and campaigned furiously for eight years against the so-called "gag" resolutions, which held in abeyance all petitions for the discussion of the abolition of slavery in the District of Columbia, finally winning the right of petition in 1844. He remained free of party affiliation and indifferent to abuse. He was stricken with paralysis in the House of Representatives on Feb. 21, 1848, and died in the Speaker's room on Feb. 23. He was buried in the cemetery of the Unitarian church at Quincy, Mass. Adams was the father of one daughter and three sons, among them Charles Francis Adams (1807-86), American diplomat.

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**ADAMS, JOSEPH ALEXANDER** (1803-80), American wood-engraver, was born at New Germantown, N.J., Apr. 14, 1803. In youth he was encouraged by Alexander Anderson, America's first wood-engraver. In 1831 he went to England to study under Thompson and Bonner. His greatest achievement consisted of 1,600 illustrations for Harper's *Illuminated Bible*, 1843. Adams died at New Germantown, N.J., Sept. 11, 1880.

**ADAMS, MAUDE** (1872- ), stage name of Maude Kiskadden, American actress, was born at Salt Lake City, Utah, Nov. 11, 1872. At the age of 16 she joined E. H. Sothern's company in New York. From 1892 to 1897 she supported John Drew; in the latter year Charles Frohman elevated her to stardom. In 1897 she first appeared as Lady Babbie in *The Little Minister*, in 1900 as Juliet in *Romeo and Juliet* and the same year created the stellar rôle in *L'Aiglon*. She appeared successively in *Quality Street*, *The Pretty Sister of José*, *'Op o' Me Thumb*, *Peter Pan*, *What Every Woman Knows*, *Joan of Arc*, *As You Like It* and *Chanticleer*. She announced her retirement in 1918, to devote herself to stage-lighting experiments in association with the General Electric Co., but in the fall of 1931 toured with Otis Skinner in a production of *The Merchant of Venice*.

**ADAMS, SAMUEL** (1722-1803), American revolutionary leader, was born in Boston, Mass., Sept. 27, 1722. He was a second cousin of President John Adams. After his graduation from Harvard in 1740 (M.A. 1743), he studied law for a brief period, but left this for an unsuccessful career in business. Business failures however were offset by local success in politics. His prominent association with the popu-

lar party enabled him to assume a position of leadership among the opponents to the Grenville legislation of 1764-65. In the latter year he was elected to the lower house of the General Court, a seat he retained until 1774. As clerk of that body and as leader of the dominant radical party he was an important influence in the opposition to the British policies towards the colonies during that period. His skill as a politician and his mastery of polemic, he used in ceaseless protests against what he considered the encroachments of England upon the rights of the colonies. During the abatement of colonial anger against the mother country after the repeal of the STAMP ACT he struggled to keep alive the anti-British feeling which the Grenville legislation had provoked. He drafted the famous "Circular Letter" to the other colonies in 1768. In 1772 he organized in Boston a Committee of Correspondence whose purpose was to acquaint other Massachusetts towns and "the world" with the hostile acts of the British government. The formation of these committees has been regarded as the beginning of the revolutionary movement in Massachusetts. Adams was an active leader in the events culminating in the Boston Tea Party and with the passage by the British Parliament of the acts intended to punish Massachusetts, he was among the first to advocate the summoning of a Continental Congress. He was elected as delegate to the first and second Continental Congress, in the latter of which he served until 1781. From the beginning of the second Continental Congress in 1775 he worked for immediate independence of the colonies and he was one of the signers of the Declaration of Independence. He was a delegate to the Massachusetts Constitutional Convention, 1779-80, and later served as Senator and member of the Council of the new state government. As a member of the Convention of 1788 summoned to ratify the proposed Federal Constitution, he voted in favor of adoption although he had at first opposed it. As Lieutenant-Governor of the State, 1789-93, and as Governor, 1794-97, he helped to suppress the movement of unrest of which SHAYS'S REBELLION was a part. He died in Boston, Oct. 2, 1803.

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**ADAMS, WALTER SYDNEY** (1876- ), American astronomer, was born at Antioch, Syria, Dec. 20, 1876. Graduating from Dartmouth College in 1898, he continued his studies at the University of Chicago and at Munich until 1901 when he became a member of the staff of the Yerkes Observatory. In 1904 he joined the Mount Wilson Observatory staff, becoming astronomer in 1909 and director in 1923. He was awarded the gold medal of the Royal Astronomical Society in 1917, the Draper medal in 1918, and the Janssen medal (French) in 1926.

**ADAMS, WAYMAN** (1883- ), American portrait painter, was born at Muncie, Ind., Sept. 23,

1883. He studied in America under Chase and Henri, also in Italy and Spain. In 1914 he was awarded the Proctor Prize of the National Academy of Design. He also won the Logan Medal of the Art Institute of Chicago, in 1918, the first Altman Prize of the National Academy of Design in 1926 and the Dana Water Color Medal of the Pennsylvania Academy in 1929. As a portraitist Adams excels in catching the picturesque aspects of a character, a good example of this being his portrait of Joseph Pennell in the Art Institute of Chicago.

**ADAMS, WILLIAM TAYLOR** (1822-97), American juvenile writer under the nom-de-plume "Oliver Optic," was born at Medway, Mass., July 30, 1822. He taught in the public schools in Boston and later became editor of *Oliver Optic's Magazine for Boys and Girls*. Among his works are *Onward and Upward* and the *Riverdale Series*. Adams died at Boston, Mass., Mar. 27, 1897.

**ADAMS**, a town in Berkshire Co., northwestern Massachusetts, situated on the Hoosac River, 15 mi. north of Pittsfield. It is served by the Boston and Albany Railroad. The leading crops of this region are apples and vegetables. Adams is a manufacturing center, producing chiefly cotton, paper and woolen goods. In 1929 the retail business amounted to \$4,264,626. About 5 mi. away is Mt. Greylock, the highest point in Massachusetts, which affords a magnificent view of the Berkshires, the Green Mountains and the Hoosac and Housatonic valleys. The settlement, known originally as East Hoosuck, was surveyed in 1749, and in 1778 was incorporated as a township and named for Samuel Adams. Susan B. Anthony, the suffragist, was born here. Pop. 1920, 12,967; 1930, 12,697.

**ADAM'S-NEEDLE**, a species of *YUCCA* (*Y. filamentosa*) native to the southeastern United States and extensively planted for ornament. The very short stem bears a basal rosette of narrow leaves with long, threadlike fibers on their margins and a tall flower stalk, sometimes 10 ft. high, terminating in a large panicle of white, drooping flowers.

**ADAMSON LAW**, enacted Sept. 3, 1916, reducing the working day of railroad employees, as, engineers, firemen, trainmen and conductors, to eight hours without diminution of the daily wage, and with proportional pay for overtime; a notable extension of federal control of interstate commerce. The four railway labor brotherhoods, numbering 325,000 men, whose demands had been refused by the railway executives, planned a general strike to begin on Sept. 4. President Wilson appeared before Congress on Aug. 29; because of his insistence, within 100 hours the Adamson Law was passed. A District Court decision that the law was unconstitutional was reversed by the Supreme Court Mar. 19, 1917, with a "five to four" decision.

**ADANA**, a city of Asiatic Turkey, capital of the vilayet of Adana, situated on the Seihan River, the Saurus of antiquity. A railway built in 1887 serves as a means of communication between Adana and

Tarsus and Mersina. The mountains of the vilayet are rich in minerals. Fruits, cotton, cereals and vegetables are grown on the plain which is well watered by the streams of the Taurus. The town has spinning-mills, riverside quays and imposing buildings. In Roman times it was an important eastern post. A ruined castle supposedly built by Haroun-al-Rashid in 782, a stone bridge and some fountains are notable architectural features. In 1909 it was the scene of a Turkish massacre of the Armenians. Pop. 1927, 109,215.

**ADAPA**, in legend, the son of Ea who gave him great wisdom, was born at Eridu in Babylonia. According to the myth, as he was fishing he was blown by the south wind into the sea. In revenge he damaged the wings of the south wind so that it could blow no more. Anu, the god of heaven, called him to account. The gods Tammuz and Gishzida pled for him, saying he had such wisdom that he should be made immortal. He would not accept the bread and water of immortality tendered by Anu, because his mother had warned him not to eat anything that Anu gave him, thinking it would be the bread and water of mortality. Thus he lost the chance of immortality and man remained mortal.

**ADAPTATION**, in biology, a term used in biological and especially ecological and evolutionary discussions, to refer to the relation by which a creature is fitted to the various elements of its surroundings (*see* ENVIRONMENT). The elements to which an organism must be adjusted to survive may be grouped into: 1, those that enable it to get the necessary materials for existence, such as food, water, air, heat; 2, those that save it from being destroyed by elements of its environment, such as unfavorable physical occurrences and the other creatures which might prey on it; and 3, those which enable it to continue its kind, and place its offspring where they in turn will be able to survive. The word *adaptation* is used equally of the relation which adjusts the organism to an element of its environment and of the actual structure in which it is physically expressed.

While organisms are in general broadly adapted to their environment, we no longer expect to find that all details of structure and behavior are necessarily adaptive. Thus fish are adapted to live in water and birds to fly in the air but the specific details of manner of swimming or of flight, such as the three beats of a woodpecker's wings followed by a wing rest, while characteristic, are not *necessarily* adaptive.

Many structures and bits of behavior which now fit an organism to its environment may have been developed in an entirely different connection from that in which they are now used. When a man faints, he falls prone because the brain lacking an adequate blood supply is no longer able to maintain the delicate adjustment needed in standing erect. It is true that lying prone is an excellent position for recovering from a faint but the position is not assumed as an adaptation for that particular purpose. With animals certainly we are not in a position to

state in many cases whether or not a given apparent minor adaptation is one which has arisen in connection with the environment which it appears to fit, or has arisen independently and the animal has moved into an environment which the structure or new behavior fits. Animals and plants must be adapted to their environment in most of their contacts in order to continue to exist; the higher the percentage of adjustment, the stronger the hold the animal has upon continued existence.

There is one idea inherent in the word adaptation which most biologists dislike which can be illustrated by using a watch for illustration. A watch is adapted for keeping time because it has been built for that purpose; it has had intelligence expended upon it. The more intelligence, the better the watch. We have no evidence that adaptations of animals and plants in nature are due to their having had some sort of supernatural intelligence expended upon them to make them what they are. It is interesting to note that the environment is as much suited to having organisms live in it, as plants and animals are adapted for living. In fact a critical examination of the environment reveals the fact that in each essential property and certainly in the combination of all, it is nearly or quite the best possible environment for life as we know it.

The following cases are typical adaptations. One of the basic needs of a plant is *carbon*, which is a food material which goes into the composition of practically all the parts of the plant. The plant obtains this from the carbon dioxide of the air, and outside energy is needed to release it from this compound and build it up into the sugars and amino-acids which are in turn built into living substance or used as a source of energy. To obtain the carbon dioxide the plant must have an effective contact with the air (or the air dissolved in water in the case of aquatic plants). The leaf serves this purpose, and may be considered in part as an adaptation for obtaining carbon dioxide. As the amount of carbon dioxide in the air is very small, a very large surface must be exposed to give opportunity for its absorption, and the surface is enormously increased by having a large number of open spaces in the texture of the leaves, which communicate with the outside by many pores or *stomata*. In this way almost every cell of the leaf may be in direct communication with the air. Then the cell sap has dissolved chemical substances which combine with the carbon dioxide and bring it to the *chlorophyll* which is the substance that can convert it into useful carbon compounds. Secondly, to obtain the energy needed for this chemical change, there must be an adaptation for obtaining energy from the sun's light. Leaves which are characteristically broad and thin are remarkably well adapted for the reception of light. In the interior of the leaf there is chlorophyll (a mixture of two or three similar green substances) which absorbs part of the light and uses the energy thus obtained to change the carbon dioxide brought to it by the cell sap into use-

ful substances. It would appear that the chlorophyll itself, which is a very complex substance, has the power to convert the carbon dioxide and simple nitrogen compounds with which the cell sap supplies it, directly into sugars and amino-acids. Then the cell sap removes these substances (which are soluble in water) from the vicinity of the chlorophyll and carries them, with the aid of the sap in the plant's vessels, to wherever they are needed. Each of these successive processes is an *adaptation* to the obtaining of carbon as a food, and each of the structures used is an adaptation for the process which it carries out.

Roots and root hairs are especially well adapted for the absorption of water from the soil. Flowers are remarkably adapted for pollination and seeds are adapted both for dispersal and for the maintenance of vitality until requisite conditions are found for germination. Indeed, most plant structures and processes are clearly adaptations. Natural selection results in the survival of the fittest, which, in other words, is the survival of the adapted.

With animals, the major adaptations center about the fundamental process of reproduction, respiration, nourishment, including the collection of food, and protection from the physical environment and from other animals or plants. A partial cataloging of the various adaptations that occur under these various heads would carry us through much of the content of animal biology. We would find that gills of various sorts are fitted for aquatic respiration as lungs are an adaptation for air breathing; that obtaining nourishment involves coloration, locomotion, food grasping, food digestion and distribution to the recesses of the body and the elimination of wastes; that protection may include coloration, locomotion, the presence of a hard outer shell, the ability to heal a wound or to regenerate a lost part, even a lost head in lower animals, the acquirement of immunity from the attacks of microbes, the evolution of appropriate instincts and the development of conditioned or learned behavior, which involves the physiology of the nervous system and of endocrine glands. Reproductive adaptations include the fundamental ones dealing with fertilization and heredity as well as the intricate and frequently marvelous minor mechanisms involved in particular instances.

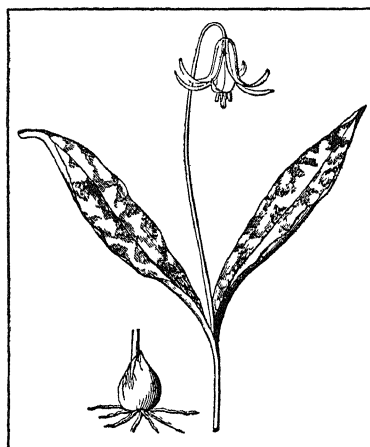
**ADDAMS, JANE** (1860- ), American sociologist, was born at Cedarville, Ill., Sept. 6, 1860. She was graduated from Rockford College in 1881 and after studying social and economic conditions in the United States and Europe she established Hull House, a West Side settlement in Chicago, Ill., in 1889, and served as head resident. Hull House became internationally known for its methods of social welfare work, and for its leader's enlightened treatment of economic and sociological problems. Miss Addams recounted the history of the establishment in two books, *Twenty Years at Hull House*, 1910, and *Second Twenty Years at Hull House*, 1930. In 1909 she was president of the National Conference of Charities and Corrections. The year following she obtained a degree in sociology

at Yale. She was later president of the Women's International League for Peace. In 1931 she was awarded the Nobel Prize for work on behalf of peace, jointly with Nicholas Murray Butler.

**ADDAX** (*Addax nasomaculatus*), a large, pale-colored antelope which ranges the deserts of north Africa from the Sahara to the Sudan. The genus of which this is the sole species is distinguished by long spirally twisted horns, borne by both sexes, and broad, shallow hoofs adapted to sand travel. The addax is a stoutly built, somewhat ungainly animal, standing about 42 in. high at the shoulder, with long ears, and a long, tufted tail. In color the rump, under parts and legs are whitish, the head and back sandy, contrasting with a brown shaggy mane and fringes on forehead and throat. A conspicuous white blaze crosses the nose. Arabs hunt this fleet and wary antelope for food and for sport.

**ADDER**, a common name for poisonous snakes of the group of true vipers (*Viperinae*). In the United States two pit vipers (*Crotalinae*), the water moccasin and the copperhead, are sometimes called adders. The name is also given to certain harmless snakes, as the HOG-NOSED SNAKE or spreading "adder," which resemble adders in appearance or actions. The true adder is the common viper (*Vipera berus*) of Europe. This snake is variable in color. Along the back it has a line of connected diamond-shaped marks. It is the only venomous snake found in Great Britain. Its poison is not very strong, and its bite is seldom fatal to grown people. Many adders, however, such as the African puff adder (*Bitis arietans*), are very deadly.

**ADDER'S-TONGUE**, the common name for a genus (*Erythronium*) of herbaceous plants of the lily family comprising several of the most beautiful North



YELLOW ADDER'S-TONGUE OR TROUT LILY

American wildflowers. There are about 13 species, all natives of the United States and Canada except one found in Europe and Asia. They are low perennials rising from deep-seated solid bulbs with an unbranched stem bearing a pair of smooth, shining leaves and large, nodding, lily-like flowers usually produced singly on a long, slender stalk but some-

times in clusters. The flowers, which range in color from yellow to cream, pink, purple and white, usually appear in early spring. Among the most handsome species are the yellow adder's-tongue or trout lily (*E. americanum*) and the white adder's-tongue (*E. albidum*), of the eastern states and adjacent Canada; the large flowered adder's-tongue (*E. grandiflorum*), with light yellow flowers in small clusters, found from the Rocky Mountains westward, and the western adder's-tongue or faun lily (*E. californicum*), native to California. The Old World species (*E. dens-canis*), called dogtooth violet, with rosecolored flowers, is planted in rockeries and borders. The name adder's-tongue is applied also to various ferns, especially to species of *Ophioglossum*.

**ADDING MACHINE.** See CALCULATING MACHINES.

**ADDIS ABABA**, the capital of ABYSSINIA, situated on the slopes of the Entoto Mountains, 8,005 ft. above sea level. In recent years some large stone buildings have been erected, and motor roads have been constructed in the city. Communications and trade are not highly developed. There is a single narrow gauge railroad, under French control, which links Addis Ababa with Jibuti, 400 mi. away on the Gulf of Aden. Three schools have been opened, of which one has English and French teachers. The fluctuating population is ordinarily about 80,000.

**ADDISON, JOSEPH** (1672-1719), British essayist, was born at Milston Rectory, near Amesbury, Wiltshire, May 1, 1672. He was educated at the Charterhouse School and Oxford and then studied for a diplomatic career. A Latin poem on the Peace of Ryswick brought him the reward of a pension which enabled him to travel and study in Europe. After his return another poem celebrating the victory of Blenheim won him a life-long Government post. He held in addition many important public offices and sat in Parliament. After much and varied writing, mostly of ephemeral consequence, Addison found his real vocation when, in 1709, he began those essays for the *TATLER* and afterward for the *SPECTATOR* and the *Guardian* which made him the most famous essayist in English literature. (See also STEELE, RICHARD.) The best known of these papers are concerned with types of character representing phases of English life, the most famous of the characters whom he thus immortalized being SIR ROGER DE COVERLEY. His polished, graceful style, charming fancy, pervading sense of humor, mastery of English and the vitality of his portrayal of life and manners quickly established him in the high repute he still holds as an essayist. He wrote also much verse and a tragedy, *Cato*, which was highly regarded for many years, but it is his essays that have survived the lapse of time. In 1716 Addison married the Dowager Countess of Warwick, and died at Holland House, Kensington, June 17, 1719. See also ENGLISH LITERATURE.

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brée, *The First Victorian*, 1925.

**ADDISON'S DISEASE**, a disorder characterized by progressive and irregularly distributed brownish discoloration of the skin, muscular weakness and general languor. The condition is accompanied by frequent vomiting, diarrhea, wasting, headache and dizziness. It is caused by tuberculous infection or atrophy of the cortex of the adrenal glands. The disease is usually fatal, but of late years the otherwise hopeless course of the disease has been improved by the administration of a recently discovered active principle of adrenal cortex in sufficient amounts to replace the normal output of the organ. (See CORTIN.)

**ADDITION**, a term used in ARITHMETIC to mean the joining of two numbers, originally by counting one, on the other. The word is from the Latin *ad*, to, + *dare*, to give or put. The numbers added are called *addends*,—rarely *summands*. The result of addition is generally called the *sum* (Latin *summa*, highest), although at one time the word product was used for the result of addition as well as of multiplication. Other words formerly used for add are *join* and *assemble*, with *summation* for addition.

**ADDRESS, FORMS OF**, the correct terms to use in addressing a person so as to accord him every courtesy or mark of respect to which he is entitled. In the United States there is a much less elaborate and complicated system of forms of address than in such a country as Great Britain. Even in the United States, however, those holding official positions—especially political, ecclesiastical and judicial ones—must be specially addressed, both in speech and in writing. In each such case, the form of address varies with the position held. Usages vary a good deal from locality to locality and from time to time, and the latest and best authorities should be consulted whenever possible.

The President of the United States when spoken to is addressed as "Mr. President." For the vice president, the same form is used as for the President; that is, he is addressed orally as "Mr. Vice President." An ambassador is addressed orally as "Your Excellency." In correspondence in his own country he is addressed with his usual title as, e.g., "The Ambassador to Great Britain," but in correspondence from some one in the country to which he is sent as ambassador he is addressed as "His Excellency, The Ambassador of the United States."

In addressing a governor of a state, "Governor" is good form (except in Virginia and Massachusetts where they are addressed as "Your Excellency"), as, "The Governor of the State of New York."

The mayor of a city should be addressed in speech as "Your Honor." In correspondence, an example of the correct form is "His Honor the Mayor of New York."

When addressing an official and his wife the title Mrs., followed by the last name, should be included in the address, as, e.g., "The President and Mrs. Hoover," or "The Ambassador to Great Britain and Mrs. Black." In social address the word "honor" is used generally by those who are of less social promi-

nence or rank, while the word "pleasure" is used among people of equal rank. Place cards for guests as at a dinner should correspond to the manner in which the invitation is addressed to them, as, e.g., if the President accepted an invitation his place card would read "The President," and his wife's, "Mrs. Hoover."

Official titles in diplomatic or business circles differ generally from those mentioned above, which are used in a social manner. In writing governors, cabinet officers, ambassadors, ministers, judges, congressmen, the secretary to the President, assistant secretaries of executive departments, and heads of independent boards and commissions the title "The Honorable" should be used. The title "Esquire" should be used after the names of chief clerks and chiefs of

bureau or executive departments and mayors of cities (when the title is placed after the name). This also applies to diplomatic officers below the grade of minister, consular officers, the clerk of the United States Supreme Court and officers of other courts. In fact, it applies to most titles. Professional titles are rarely used in address, except officially, "Mr." or "Esquire" being preferred. When professional abbreviations as LL.D. or D.D. and the like are used they follow the name and title. "Mr." is omitted as "John Jones, LL.D."

In correspondence with persons not having honorary titles "Mr. and Mrs." should be used in addressing a man and his wife; "Mr." or "Esquire," a single man; and "Mrs." or "Miss," a single woman. The following table should be helpful.

RANK	ADDRESS ON ENVELOPE	SALUTATION
President of the United States	The President, Washington, D. C.	Sir; To the President; My dear Mr. President; Dear Mr. President
Vice-President of the United States	The Vice-President, Washington, D. C.	Sir; My dear Mr. Vice-President; Dear Mr. Vice-President
Cabinet Member	The Secretary of— Washington, D. C. or The Hon. D— C— Secretary of— Washington, D. C.	Sir; Dear Sir; My dear Mr. Secretary; Dear Mr. Secretary
Chief Justice of the Supreme Court	The Honorable, the Chief Justice, Washington, D. C.	Sir; Dear Mr. Chief Justice
Other Justices of the Supreme Court; Justices of Superior Courts; Governors of states; Senators and Representatives of the United States and members of the Legislatures of the various states; ex-Presidents and other ex-officials of high rank	The Hon. E— D— (Official Address)	Sir; Dear Sir; My dear Sir; Dear Governor C—; Dear Mayor B—; Dear Judge R—; Dear Mr. S—; etc.
Cardinal	His Eminence <i>Henry</i> Cardinal B—, Archbishop of M—	Your Eminence
Bishop (Roman Catholic or Anglican)	The Rt. Rev. A— B—	Right Reverend and dear Sir; Right Reverend and dear Bishop; My dear Bishop B—
Priest	The Rev. J— R—	Reverend and dear Sir; Reverend and dear Father; Dear Father R—
Clergyman	The Rev. R— B—	Dear Sir; My dear Sir; Dear Dr. (or Mr. if he holds no doctoral degree) B—
Rabbi	The Rev. J— S— or Rabbi J— S—	Dear Sir; Dear Rabbi S—
	<i>Forms of Address in Great Britain</i>	
King	The King's Most Excellent (or Gracious) Majesty	Sire; May it please your Majesty
Prince	His Royal Highness the Prince of Wales His Royal Highness Prince G—	Sir; Your Royal Highness

RANK	ADDRESS ON ENVELOPE	SALUTATION
	<i>Forms of Address in Great Britain</i>	
Duke and Duchess	(Formal) The Most Noble the Duke of— or His Grace the Duke of—  (Informal) The Duke of—	My Lord Duke; Your Grace; Sir  Dear Duke of—; Dear Duke
Marquess (or Marquis) and Marchioness  (Note: Marquess is the older title, Marquis the more common.)	(Formal) The Most Honourable the Marquess of— (Informal) The Marquess of—	My Lord Marquess; My Lord Dear Lord—
Earl and Countess	(Formal) The Right Honourable the Earl of—  (Informal) The Earl of—	My Lord Dear Lord—
Viscount and Viscountess	(Formal) The Right Honourable the Viscount—; The Lord Viscount—  (Informal) The Viscount—	My Lord Viscount Dear Lord—
Baronet	(Formal) Sir <i>Christian name surname</i> , Bt. (or Bart.) (Note: Bt. is the older abbreviation, Bart. the more common)  (Informal) Same as above, but without the Bt. or Bart. (Note: The wife of a Baronet is addressed as Lady <i>surname</i> )	Sir; Dear Sir Dear Sir <i>Christian name</i>
Knight	(Formal) Sir <i>Christian name surname</i> . Knight (or Kt.) is sometimes added, or the letters indicating the Order to which the Knight belongs and the rank he holds in the Order—K.G., K.C.M.G., etc. If he does not belong to one of the ten Orders, such abbreviated titles as M.P., M.D., or R.N. may follow his name if he is entitled to them.  (Informal) Same as above, but without any titles following the name	Sir; Dear Sir Dear Sir <i>Christian name</i>
Daughters and younger sons of Duke or Marquess, and daughters of Earl. (Note: The oldest son of a Duke or Marquess has a courtesy title of his own)	The Lord <i>Christian name surname</i>	My Lord; Lady; Dear Lord, Lady <i>Christian name</i>
Younger sons of earls (Note: The oldest son has a courtesy title of his own), all sons and daughters of viscounts and barons	The Honourable <i>Christian name surname</i>	Dear Sir; Dear Mr. B—
		L. H. G.

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**ADDRESSING MACHINES**, a type of duplicating machine designed to duplicate a number of separate imprints once or twice with each run, used for addressing newspapers and envelopes, and in making invoices, statements and other office records. Addressing machines print from metal plates, stencils, or type. These are fed from a magazine to the printing table where they are pressed against the material to be addressed by a stamping arm. Ink is applied directly or by a ribbon.

**ADE, GEORGE** (1866- ), American author and playwright, was born at Kentland, Ind., Feb. 9, 1866. He was educated at Purdue University. Ade is best

known for his *Fables in Slang*, but his writings in the field of humor and humorous philosophy have been extensive; he has also written many plays, including *The College Widow*, produced 1904, and *Father and the Boys*, 1908. Among his principal works are *Artie*, 1896, *Pink Marsh*, *Doc Horne*, *Fables in Slang*, 1899, *More Fables*, *The Girl Proposition*, *People You Knew*, *Breaking Into Society*, 1903, *True Bills*, *In Pastures New*, *The Slim Princess*, 1907, *Hand-made Fables*, 1920, *Single Blessedness*, 1922.

**ADELAIDE**, an Australian city, the capital of South Australia, situated 6 mi. from Port Adelaide on St. Vincent Gulf. The population of Adelaide



and its suburbs is 57% of the total population for the entire state.

The town is built on the banks of the Torrens, a small river which has recently been artificially dammed and converted into a beautiful lake. The streets are broad and there are many fine structures, among them the University of Adelaide and two cathedrals. The prosperity of the city depends upon the agricultural and pastoral products of the surrounding districts. Incorporated in 1840, Adelaide was the first settlement in Australia proclaimed a city. It is named after the wife of William IV. Pop. with suburbs, 1929, 324,898.

**ADELAIDE, UNIVERSITY OF**, a coeducational institution at Adelaide, Australia, was established by act of the Provincial Legislature in 1874. The foundation was made possible by gifts of £20,000 each from Sir W. W. Hughes and Sir Thomas Elder, and a land grant of 50,000 acres. Since then additional grants from the State Parliament and private donations have made an endowment fund of £593,329. The university comprises departments of Arts, Science, Law, Medicine, Dentistry, Music, Agriculture, Science and Applied Science. It includes the Elder Conservatorium of Music, and aids in the management of a Public Library, Museum and Art Gallery. The Waite Agricultural Research Institute offers special facilities for the study of plant pathology, soil chemistry and entomology. Other special research departments include the Sheridan Medical Research Foundation, the Animal Products Research Foundation, the Board of Anthropological Research, and the Anti-Cancer Campaign Committee. The library contains over 82,000 volumes. In 1930 there were 2,515 students, and a faculty of 45 headed by Sir G. J. R. Murray, Chancellor.

**ADELPHI**, a Latin comedy by **TERENCE**, borrowed from the *Adelphoi* of Menander and the *Sunapothneskontes* of Diphilus. The education of two brothers, Aeschines and Ctesiphon, by their father, Demea, and their uncle, Micio, the mistakes which were made with the one on the score of indulgence and with the other through too much severity, is the central theme of this comedy, Terence's last. The plot of Molière's *École des Maris* (see **SCHOOL FOR HUSBANDS**) was largely suggested by *Adelphi*.

**ADELPHI, THE**, a dignified residential locality in London, between the **STRAND** and the Thames Embankment, east of Charing Cross. The quarter was laid out in 1769-73 by the architects Robert and James Adam, with streets named after the four Adam brothers (Robert, James, John and William) and its general name taken from the Greek word *Adelphoi*, meaning Brothers. The imposing Adelphi Terrace House overlooking the river, was built by Robert Adam, and was avowedly inspired by the Roman Palace of Diocletian at Spoleto; it was badly remodeled in 1872. Among the celebrities who have lived there are David Garrick (at No. 5), George Bernard Shaw (No. 10), and Sir J. M. Barrie, who still resides at No. 3. The Royal Society of Arts is

housed in one of Robert Adam's buildings in John Street.

**ADELPHI COLLEGE**, at Garden City, N.Y., a privately controlled non-sectarian college for women, was incorporated by the Regents of the University of the State of New York in 1896. Until 1913, when it was chartered to grant degrees in its own name, degrees were given by the university upon recommendation of the college authorities. It became exclusively an institution for women in 1917. The productive funds of the college in 1931 were \$250,620. The library contains 30,135 volumes. In 1931-32 there were 575 students and a faculty of 47, headed by Pres. Frank D. Blodgett. It was formerly located in Brooklyn, N. Y.

**ADEN**, a volcanic peninsula on the south coast of Arabia, about 100 mi. east of the Straits of Babel-Mandeb, the entrance to the Red Sea. A British possession, the settlement also includes the island of Perim in the Straits themselves. Aden is important as a fortified coaling station on the highway to India and the East. The settlement includes an area of 75 sq. mi., Perim 5 sq. mi., and in addition the hinterland forms a British protectorate with an area of 9,000 sq. mi. Aden is under the administration of the Presidency of Bombay, five days away by steamer. The population including Perim is 54,923 and chiefly composed of Arabs and Somalis from Africa all speaking Arabic.

**ADENITIS**, inflammation of a gland, especially of the lymph glands of the neck. These glands drain the lymph from teeth, tonsils, mouth, nose and ears. Infection of any of these tissues may lead to inflammation and swelling of the lymph glands in the neck. The affection may be acute or chronic, in the latter instance being the result of tuberculous infection.

When pus forms in the glands, they may have to be cut open and drained. Tuberculous infection of these glands in the adult is usually treated surgically. In the child, however, general treatment for tuberculosis is relied upon.

**ADENOIDS**, localized masses of lymphoid tissue located at the point of junction of the upper end of the throat and nose. Their structure is similar to that of the faucial tonsils, better known merely as tonsils. Similarly to lingual tonsils, these pharyngeal tonsils may become enlarged, in which condition they constitute adenoids.

Enlargement occurs almost exclusively in early childhood. Nursing children may breathe with great difficulty and choke. This indicates that adenoids are present, which are blocking the nose. Enlargement occurring or continuing during childhood may be suspected by the following symptoms: snoring, mouth breathing, a broad low nose, narrow nostrils, open mouth, high arched palate, and overcrowding of teeth. A narrowing of the chest may develop, and ear infections may result from blocking of the passage between ears and nose.

If allowed to remain, the anatomical changes become irremediable, sleep is disturbed, hearing is



altered, digestion and appetite are interfered with, weight and health are lowered, the child appears stupid and falls behind at school; nose and ears are rendered more likely to infection, thus needlessly endangering the health of the patient.

The only satisfactory treatment for adenoids is removal. This should be performed as early as possible, so that disfigurement and weakening may not result. This is a comparatively slight operation, and if performed by a competent medical man is usually entirely without danger.

R. So.

**ADEVISM**, a denial of pagan gods, as distinguished from **ATHEISM**, or denial of God.

**ADHESIVES**, substances used for the purpose of effecting the adhesion of the surfaces of bodies. They must be able to wet the surfaces and form a relatively continuous film. Adhesives obtain their grip on a body either through being adsorbed by it, or by penetrating the more or less rough surface, thereby effecting an anchorage for the film formed by the subsequent solidification of the adhesive. Substances fulfilling these requirements are different from the materials to which they are applied, and are usually concentrated viscous liquids which gel, but do not have a tendency to crystallize at ordinary temperatures. Where the joint is formed by penetration, the strength of the union is measured by the strength of the film.

A convenient classification of adhesives, with examples of the various classes, is as follows: (1) Those which gel on cooling, for example, bone and hide glues; (2) those which gel on heating, for example, blood and egg albumens; (3) those which gel because of chemical changes, for example, casein-lime glues; (4) those which gel because of evaporation of the solvent, for example, mucilages, silicates, starch pastes, nitrocellulose glues, rubber solutions; and (5) those in which gelation is brought about without the use of a solvent, for example, phenol aldehyde condensation products.

The selection of an adhesive depends upon the nature of the materials to be joined and the conditions the finished work must withstand. Water resistance, permanence, alkalinity or acidity, glueing time and cost are only a few of the factors to consider. For satisfactory work, careful attention must be paid to the best known technique for the materials in question and this can be learned only by experience. *See also* **COLLAGEN**; **GELATIN**; **GELS**; **GLUE**; **RUBBER**; **SILICATES**.

E. S.

**ADIABATIC CHANGE**, a change in the state of a substance which takes place without gain or loss of heat. It must be distinguished carefully from an **ISOTHERMAL CHANGE**, i.e., one which occurs without change in temperature. For example, the volume of the gas contained in a cylinder may be increased by allowing it to raise the piston which confines it. If this is done without allowing the gas to absorb heat from its surroundings, the change in volume takes place adiabatically, but the temperature of the gas will fall. Similarly, if the gas is compressed adiabatically, its temperature will rise, although no heat is

added. A curve showing the relation between pressure and volume of a substance for an adiabatic change is called an *adiabatic curve* or simply an *adiabatic*.

**ADIGE**, a river of Italy, rising in the Rhætian Alps, and formed by various streamlets which unite at Glarus. It then flows east into Tirol, and after a slight detour past Trent and Roveredo it enters Lombardy, where, passing Verona, it takes a southeastern sweep to enter the Adriatic. It is 250 mi. long and is navigable for 190 mi. up to the confluence of Eisach, its chief tributary. In Nov. 1917, during the World War, the Austrians drove the Italians across the Adige with great losses.

**ADIPOCERE**, a soap-like substance produced by a certain type of decomposition in buried bodies of man and animals. As putrefaction progresses the fats are condensed in a layer under the skin, in such a manner that the contour of the body at the time of death remains unchanged. The occurrence of this phenomenon is frequently useful in medico-legal investigations, as marks of violence are frequently visible, and features are recognizable. Chemically, adipocere is a soap formed from the fatty acids derived from the fat of the body. The substance is quite firm and permanent in air, though it crumbles readily.

**ADIRONDACK MOUNTAINS**, a range in New York State, classified as part of the Appalachian system although they belong structurally to the Laurentian highlands of Canada. They are famous for the picturesque charm of their wooded slopes and beautiful lakes. This range covers an area of from 5,000 to 6,000 sq. mi. in Clinton, Essex, Franklin and Hamilton counties. The peaks of these mountains range in height from 1,200 to 5,000 ft. with the exception of Mt. McIntyre reaching 5,112 ft. and Mt. Marcy in the eastern part of the range towering to 5,345 ft. The latter was called by the Indians Tahawus, or Cloud Splitter. Forty-two of the peaks exceed 4,000 ft., the tallest of which are Skylight 4,920 ft., Haystack 4,918 ft., Dix 4,842 ft., Whiteface 4,870 ft. and the Gothics in the heart of the range, 4,740 ft. Their slopes are mantled with forests of hemlock, pine, spruce and varieties of hardwood. Lumbering, once the principal industry of this area, has been restricted by the increasing acreage being added to the New York State forest preserve which in 1929 included 1,982,924 acres in the Adirondacks. These mountains form the water-parting between the tributaries of the St. Lawrence and Hudson.

The Adirondacks to-day are chiefly important as a resort region visited every year by thousands of tourists. Numerous summer residences, hunting lodges and camps are situated near and around the most celebrated of the many lakes. Lake Placid with Whiteface Mountain at its head is both a summer and winter resort. Long Lake, Upper and Lower Saranac, the Tupper Lakes and Raquette are other favorite locations. The outstanding sightseeing features are Indian Pass, a time-worn gorge 11 mi. long between Mts. McIntyre and Wallface; and the **AUSABLE CHASM** containing the beautiful Rainbow Falls.

**ADIRONDACK PARK**, a large state park, located in the Adirondack Mountains of northeastern New York State in a highly scenic region of lakes, streams, valleys and mountains. The park, created in 1885, comprised, in 1928, 1,941,404 acres. Over 450 mi. of foot and horseback trails have been developed within the park and an interesting 100 mi. canoe trip can be made from Old Forge through the Fulton chain of lakes, Raquette Lake, Long Lake, and the Raquette River to Saranac and St. Regis Lake. Mt. Marcy, the highest mountain in the state of New York, with an elevation of 5,345 ft., and Mt. McIntyre, 5,111 ft., are included within the area of the park. Forests vary from heavy stands of virgin spruce and pine to dwarf alpine fir. Hunting, fishing and winter sports are among the many attractions.

**ADIT**, a horizontal underground passage driven into a hill from the surface to provide access to an ore deposit; also called a **TUNNEL**. It is sometimes used only for drainage, but is frequently the main entrance to the mine. *See also* MINE DEVELOPMENT; SHAFT.

**ADJUTANT**, the name applied to any one of a small group (*Leptoptilus*) of large storks found in India and Africa. These birds, of which there are three species, are about five feet in height. The bill is extremely long and heavy, the neck long and nearly naked, having a long pendant pouch at its base which is connected with air sacs. Adjutants are scavengers feeding on offal and carrion but also eating live birds, frogs and small mammals. The lower tail coverts of one species, the marabou stork of Africa, are extensively used for articles of feminine apparel. A superstition is prevalent among the Hindus that the adjutant's brain contains a small stone which is valuable as an antidote for poison.

**ADJUTANT GENERAL**, a military officer of high rank at the head of a special division of the U.S. War Department. He is charged with the duty of communicating the orders, instructions and regulations of his department; preparing and distributing commissions; recruiting; preparing publications; keeping the records; and handling matters pertaining to the education and recreation of the soldiers. Each state has an officer serving as adjutant general to the State militia. Originally, the adjutant general was an officer who acted as the chief assistant staff officer to the general in command, and the office still exists in that form in many countries, as in Germany and Russia. In Great Britain the adjutant general's office is similar to that in the United States.

**ADLER, CYRUS** (1863- ), American educator, archaeologist and Semitic historian, was born at Van Buren, Ark., Sept. 13, 1863. He graduated from the University of Pennsylvania in 1883 and took his Ph.D. at Johns Hopkins in 1887. From 1890-92 Adler was made a commissioner of the Chicago expedition to Turkey, Egypt, Tunis, Algiers and Morocco. From 1892-95 he was librarian of the Smithsonian Institution and from 1889-1908 was curator of historic archaeology and historic religions at the United States Na-

tional Museum. In 1908 he was made president of Dropsie College for Hebrew and Cognate Learning, Philadelphia. Adler is the author of many articles on Semitic philology, Assyriology, Oriental archaeology, comparative religion, bibliography and American Jewish history. He was one of the editors of the *Jewish Encyclopaedia* and was editor of the so-called *Jefferson Bible* and of the *American Jewish Year Book*. He is the author of *Told in the Coffee House*. From 1929-30 Adler was joint chairman of the Jewish Agency for Palestine, and from 1930-31 acting chairman of the council.

**ADLER, FELIX** (1851- ), American educator and philanthropist, was born at Alzey, Germany, Aug. 12, 1851, son of a Jewish rabbi. He came to the United States in 1857 and graduated from Columbia in 1870, later studying at Berlin and Heidelberg. In 1874 he became professor of Hebrew at Cornell University, and in 1876 organized in New York the Society for Ethical Culture. He took a prominent part in movements for social betterment, notably the erection of model tenement houses and the abolition of child labor. Among his writings are *Creed and Deed*, 1877; *Marriage and Divorce*, 1905; *The Religion of Duty*, 1905, and *An Ethical Philosophy of Life*, 1918.

**ADMETUS**, a Thessalian hero and king of Pherae. He sought the hand of Alcestis, daughter of PELIAS, who insisted that he should claim his bride in a chariot drawn by lions and boars. APOLLO helped him to fulfill this condition, but after the marriage Admetus omitted to sacrifice to Artemis. In the bridal chamber, therefore, he found a bundle of snakes and was only saved by the further intervention of Apollo, who promised him that his life would be prolonged if, at the hour of his death, any one could be found who would die for him. Alcestis consented, and was only rescued by HERCULES who contended with death on her behalf.

**ADMINISTRATION OF LAW.** *See* LAW, ADMINISTRATION OF.

**ADMINISTRATIVE LAW** prescribes the powers and procedure of public administrative officials and their relations to the judicial and legislative branches of government. Its principles safeguard private persons against bureaucratic oppression; they also provide methods of effectuating governmental control over social and economic adjustments for which courts and legislatures alone are inadequate. Although many of these principles are not new, administrative law did not, either in England or in the United States, receive recognition as a distinct body of law until the growing complexities of 20th century civilization led to the widespread creation of regulatory boards, licensing commissions, and other administrative offices. Even yet this body of law is rather shapeless and disjointed. The boundaries which mark it off from constitutional law and other branches of law, are not well defined; and the application of administrative principles varies greatly with the type of official and the regulatory function which he performs.

Whether or not the legislature has power to enact a law regulating certain activities or interfering with private property for a certain purpose, is a question of constitutional law. Whether or not the legislature may lawfully delegate regulatory power to an administrative board or official, is primarily a question of constitutional law; yet the principles limiting such delegation also control interpretation of the statutory powers and procedure of administrative bodies in operation, and hence belong to administrative law. The principle that every man is entitled to an impartial hearing before any final official decision to interfere with his person or property, is applied as a constitutional requirement to test the validity of legislation and as an administrative requirement to test the validity of administrative action. In some instances a formal notice and hearing precede decision, as with the Interstate Commerce Commission and the Federal Trade Commission; in others the decision is not final until a judicial hearing, as with many decisions of state insurance commissioners.

Administrative officials often possess subsidiary legislative powers, such as the powers of the Interstate Commerce Commission to prescribe general schedules of railroad rates; they sometimes exercise judicial powers, such as the adjudication by Workmen's Compensation Boards of industrial accident claims formerly passed upon by courts; and they usually have limited executive powers to enforce their decisions by indirect sanctions, such as revocation of license. Concentration of these powers in a single official or board, often unavoidable if effective governmental control is to be maintained, infringes the theoretical separation of powers into executive, legislative and judicial. Yet safeguards against bureaucratic oppression may be found in careful legislation, in the selection and removal of officials and in judicial review of administrative acts. The ordinary law courts, in the United States, give private persons relief where administrative officials exceed their powers, abuse their discretion, or deny a fair hearing. Some types of administrative decision are treated as conclusively or presumptively correct, others are set aside if the court disagrees on the merits. In continental Europe separate administrative courts exercise the power of review. E. W. PA.

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**ADMINISTRATOR**, a person appointed by the COURT to settle and distribute the estate of a person who dies intestate. The JURISDICTION of making the appointment and passing on acts of administration is confided to courts called Surrogate, Orphans, or Probate. The law in many states is that probate distribution will not be presumed to divest the usual chancery courts of their equitable jurisdiction, even though a concurrent jurisdiction be conferred.

**ADMIRAL, REAR; ADMIRAL, VICE.** Until July 1862, the United States had no officers even of the rank of rear admiral, although when the Continental Navy was established in 1775, Congress resolved that

an admiral should rank as a general; a vice admiral, as a lieutenant general; and a rear admiral, as a major general. Under the law of 1862, David G. Farragut, Louis M. Goldsborough, Samuel F. Dupont and Andrew H. Foote were commissioned to the rank of rear admiral. Farragut as senior rear admiral, hoisted his square blue flag on the *Hartford* at New Orleans. Farragut was made first vice admiral, 1864, and when promoted to a full admiral, 1866, David D. Porter was made a vice admiral. On Farragut's death, 1870, Porter became a full admiral, and Stephen C. Rowan became a vice admiral. These grades became extinct under the law, and there was no admiral until George Dewey was promoted by Congress to be Admiral of the Navy, in 1899.

Aug. 29, 1916, Congress provided for the temporary rank of four admirals, now held by the Chief of Naval Operations, the Commander-in-Chief U.S. Fleet, the Commander Battle Force and the Commander-in-Chief Asiatic fleet; and three vice admirals, the Commander Scouting Force, the Commander Battleships Battle Force and the Commander Cruisers Scouting Force. On June 21, 1930, Congress advanced ten retired rear admirals to the rank of admiral on the retired list, and six retired rear admirals to the rank of vice admiral on the retired list.

Until the Civil War, captains of the U.S. Navy commanding or having commanded, SQUADRONS, were recognized as commodores, though never commissioned as such until 1862. The grade of commodore exists only as a retired position, and will eventually become extinct. See also FLAG OFFICER. R. E. C.

**ADMIRALTY ISLANDS**, a cluster of about 40 islands northeast of New Guinea. In 1929 there was a native population of 13,904. The islands form a part of the Bismarck Archipelago, and became a German protectorate in 1884. In Nov. 1914 they were occupied by Australian troops and were awarded to Australia as mandatory in 1919. The natives are Papuan cannibals, gradually becoming civilized.

**ADMIRALTY LAW**, the system of jurisprudence in Admiralty Courts. In the United States there are no Admiralty Courts as distinct from others, but such jurisdiction rests in the United States District Courts. Their decision may be revised by the U.S. Circuit Courts and finally by the Supreme Court of the United States. Cognizance is taken of collisions at sea, torts, maritime contracts, war prizes and cases of such character. In the United States certain cases arise out of the navigation of its rivers, Great Lakes and other public waters. In England, admiralty jurisdiction was formerly vested in the High Court of Admiralty; but now in general, it is vested in the Admiralty Division of the High Court of Justice. R. E. C.

**ADOBE**, a gray-brown or yellowish calcareous CLAY, fine-grained and porous, of widespread distribution in arid regions. It crumbles readily in the fingers, yet will stand in vertical banks for years without breaking down. Adobe forms the soil of a great part of the rainless regions of western North America and of the other deserts of the world. It is

the accumulated waste from surrounding highlands, resulting largely from the mechanical disintegration of their rocks. Winds and ephemeral streams concentrate it in the valleys, filling them with fine soil sometimes thousands of feet thick. Microscopically it consists mostly of minute particles of quartz with occasional silicates, some clayey and some calcareous material. Because this rock débris has been but slightly subjected to the leaching action of water it still contains soluble, limy matter. Consequently, if the adobe is wetted this soluble material cements the particles together as it dries out. Sun-dried bricks were made in this manner by the ancient Egyptians, and are made to-day by the Indians in southwestern United States and in Mexico. The presence of the soluble silicates and carbonates of potash, soda and lime renders the adobe soil remarkably fertile when irrigated.

**ADOLESCENCE**, the period from puberty to the full maturity of the adult. Puberty is marked by the establishment of the reproductive function, which on the average occurs in girls toward the close of the 13th year, and in boys about two years later. The pubescent period is that preparatory to these changes, from the 10th to the 12th or 14th year, which may be regarded as the end of childhood. The rapid increase in physical growth in the pubescent years is replaced by a more gradual one. Physical reconstruction is accompanied by an equally marked psychic, mental and emotional, transformation.

**General and Physiological Aspect.** While the focus of transformation in the pubescent and early adolescent period is in the physiology of the reproductive functions, the entire organism participates in this completing stage of nature's maturation. The secondary sex changes are the appearance of the pubic hair, of the beard and the change of voice in boys, and the enlargement of the pelvis and bust in girls. Psychologically it is a period of transition, unrest, experimentation. Though all growth is continuous, and though in some cases adolescence proceeds gradually and evenly, and in others is violent and sudden, adolescence is in all a period of accentuation and reconstruction, so much so that it is often called a rebirth.

The acquisition of adult status is recognized among primitive peoples by rites of entry into tribal life, and is surrounded in historic cultures by social and religious ceremonies, such as confirmation. Coming of age marks an epoch. With the lengthening of the educational process and the postponement of adult responsibility, adolescence is itself prolonged and may be said to last through the 'teens and beyond. The achievement of an adequate personal and social control is strongly affected by the successful transition to and through adolescence. It is in many directions a critical period.

**Sex and Social Maturing.** The psychology of adolescence is centered in the conscious adjustment to a more complex social environment. Childhood is past, however persistent many of its traits; the basic bodily and mental habits have been established. Ad-

lescence continues them in an expanded setting. The primary emphasis of nature is upon the physiological reconstruction. The core of adolescence is a sex maturing, distinctive for the boy and for the girl, so distinctive that the common factors of the adolescent psychology become subordinate to the sex determined ones. All descriptions must be adapted to this divergence. It is not merely an approaching maturity and the mental and emotional changes that go with it, that set the adolescent course, but the assumption of a full masculinity and femininity. Despite the large molding forces of the environment that shape the adolescent's life, and increased sensitiveness and responsiveness to it are themselves characteristic, there are definite indications of nature set changes, all converging upon the formation of a mature adult equipment.

In the male notably the greater strength, endurance, the need of activity, exercise, sport, recreation, contests, adventure, jobs, travel, animal spirits, indicate the motor tempo. Muscle maturity and sex maturity go together, and emotional and intellectual maturing no less. To utilize the motor channels to lessen the sex tension, and in that sense find wholesome sublimated outlets for it, is an accepted precept in the direction of this period to a normal issue. (*See CHILD AND YOUTH, GUIDANCE OF*).

The social outlets are equally dominant, especially in relations between the sexes represented by dancing, and the challenge of mutual regard. Masculine prowess and display before the opposite sex have ever been associated. The formation of gangs, cliques and group loyalties is characteristic, and becomes a passion at this age. Mental expansion leads to reflection upon larger problems of the nature of the world and human destiny; this is the religious aspect of adolescence. Exploration, roving, travel, seeking contacts through a zest for experience is a parallel expression of the adolescent enterprise. The introspective turn, brooding, despair, rebellion, or retreat, marked aggression or doubt and uncertainty, rapid shifting of mood and interest, the orientation to the invisible universe, enter into the picture. The awakening of the inner life culminates in the intensive consciousness of self as a personality. The adolescent strivings and demands have not yet found their adjusted, poised expression. The motor apparatus is not yet under adequate control; hence boisterousness or awkwardness, and especially inexperience in social maneuvers, as youth has its fling. Hence craving for excitement, intensive stimulation, thrill and motor satisfactions; or, in other setting, dreaminess, vague yearning, romantic escapades, poetic flights.

**Social Aspects.** The adolescent temper appears as variously as the social habits and customs provide a setting for its expression. It may appear in a deeper absorption in beauty, in passionate enthusiasms and devotions as well as antipathies, jealousies and animosities. It may appear as a craving for notice and display, and equally the uneasy embarrassment in exposure to public regard. It may take the form of religious occupations and conversions, or of grandiose

ambitions, day-dreaming, hero-worship, exaggerated sentiments, vanity, conceit. Yet with all these less tangible yearnings, this is also the period of coming to terms with the routine task, the assumption of responsibility, the preparation for a career, experimentation with a variety of aptitudes to sound their depth, finding of one's enduring tastes and interests. Because the distinctive qualities of adolescent behavior focus in this indeterminate and often unaccessible field, subconsciously active, privately cherished, in part reluctantly acknowledged, that the ordinary methods of psychological study, such as apply to childhood, are inadequate.

The study of adolescent psychology must ever proceed upon a deep sympathetic understanding; and the same applies to guidance and direction. The intimate phases of conduct and attitude represent the essential dynamics of adolescence.

**Problems of Adolescence.** In summary, the notable adjustments of the adolescent are in relation to the opposite sex with all its implications; to the assumption of independence, which is concretely expressed in the reaction to authority, of parent and teacher and the social forces. Wayward expressions in both relations are imminent under the passion and power of urges as yet inadequately controlled. Rebellion against authority, violations of the moral code, a sullen disregard, a disdain of the attachments which up to that time marked the dependence of child upon parent, all these present personal as well as social problems in instability, such as sowing wild oats before settling down to the maturer order of satisfaction. Hysterical episodes in girls, bids for attention, kleptomania, extravagance in dress and behavior, boyish escapades from college pranks to crime, may be interpreted as high pressure escapes of normal urges in undesirable directions.

The problem of the adolescent is thus presented as a conflict and solution, wise or foolish, normal or abnormal, of his urges with the socially available avenues of satisfaction. This view has entered into common knowledge through the Freudian approach, in which the adolescent conflict and the complexes upon which it arises are made typical for conflict and maladjustment in all its phases. The adolescent conflict continues and may become critical in the formation of the neuroses.

Under that view, without accepting the infant sexuality in the Freudian sense, there is focussed upon the adolescent problem the entire group of concepts such as libido, repression, sublimation, that derive from the sexual determinant and fountain source of life energy, a point of view that Freud applies throughout the life span. Consequently neuroses in one direction, delinquency and crime in another, rebellion, leaving home in another, are looked upon as false adolescent solutions of adjustment. The regressions of later life are lapses back to or imperfect outgrowth of adolescent patterns of behavior. So much of this clearly applies as to make delinquency and crime in large measure a juvenile problem. The large

quota of characteristically youthful mental disorders is evidence of a similar relation. See CHILD PSYCHOLOGY; CRIME; NEURASTHENIA. J. J.

See Schwab and Vieder, *The Adolescent: His Conflicts and Escapes*, 1929.

**ADONAI**, the title of an elegy by P. B. SHELLEY, a beautiful soaring lament on the untimely death of his fellow poet, JOHN KEATS, written in 1821, the year of Keats's death. The title was suggested by that of a character in Greek mythology, ADONIS, a beautiful youth who died in his prime.

**ADONIJAH**, a name meaning My Lord is Jehovah, the fourth son of David, by Haggith (II Samuel 3:4). By the death of his brothers Amnon, Chileab and Absalom he became, according to primogeniture, heir to the throne. His claim was supported by Joab, the general of the army, and Abiathur, the priest (I Kings, 1, 2), who gathered at "the stone Zoheleth which is by Enrogel," for a feast. Bathsheba intended, however, that her son, Solomon, should succeed, and with the prophet Nathan she persuaded the aged David to have an immediate accession by anointing him with oil. Adonijah was pardoned but when David died he was so unwise as to persuade Bathsheba to ask of Solomon the hand of the late king's concubine, Abishag the Shunammite. According to eastern etiquette this request, like Absalom's occupancy of the royal palace, implied that Adonijah had not abandoned his dynastic pretensions. Under the stern hand of Benaiah, the son of Jehoiada, Solomon's executioner, Adonijah perished.

**ADONIS**, a Greek hero and exemplar of manly youth and beauty. His mother was Smyrna, who was pursued by her father into a forest and changed into a tree. When the father smote the tree with his sword, Adonis was disclosed. He was the favorite of APHRODITE. While hunting a boar he was fatally wounded.

**ADONIS**, a group of bright-flowered plants of the crowfoot family, natives of Europe and Asia. Several species are grown as garden ornamentals. The most common are the spring adonis (*A. vernalis*), a perennial with yellow flowers, 3 in. across, the summer adonis (*A. æstivalis*), an annual with crimson flowers, 1½ in. wide, and the autumn adonis (*A. annua*, sometimes known as *autumnalis*), likewise an annual, but with smaller, deep red flowers, dark in the center. The two last named are also called pheasant's-eye. All do well in good soil in full sun or part shade; the seeds or cuttings should be planted very early.

**ADOPTION**, the legal assumption of parental rights and duties to a child, by a person or persons not previously legally entitled to parental authority and obligations. The practice of adoption goes back far in history, in widely scattered parts of the world, as, for example, among the Assyrians, the Greeks and the American Indians. English speaking nations have no common law relative to adoption. STATUTES in various states of the United States regulate adoption differently. At first, these laws, being written, were

construed too strictly for justice but a reaction came with the realization that the adoption of children is an aid, not a detriment, to the state. It is difficult to formulate a general rule regarding who may adopt children. A man or woman, if not incapacitated morally, mentally, physically, or financially, may adopt. A married couple may adopt jointly, but either may adopt separately without the other joining, in which case the adoption creates no relations between the child and the spouse who does not join. If, however, one spouse is insane, it is doubtful if the other could adopt. In some states, an unmarried person may adopt a child.

In regard to whom one may adopt, there can be no general rule. In some states any minor, in others adults and children whose parents are unknown or who have no guardian or other tie may be adopted. In some states, a non-resident may be adopted.

**ADORATION**, from Latin *ad*, to, and *os*, mouth, an act of reverence. Romans raised the hand to the mouth, kissed it and waved it toward the object venerated. The Jewish homage was a kiss. Asiatics bow the forehead to the earth. In the Roman Catholic Church the crucifix on the slipper of the Pope is kissed and the Virgin, saints, martyrs, crucifixes, relics and other sacred objects are revered. In the so-called Black Rubric of the Anglican Prayer Book it is laid down that, by kneeling at the Communion Table, "no adoration to the Sacrament is intended, or ought to be done." A provision for reserving the Sacrament, introduced into the Revised Prayer Book, aroused Protestant misgivings and led to its rejection by the House of Commons, Dec. 15, 1927 and June 14, 1928.

**ADORATION OF THE CROSS, THE**, is included in the morning office of Good Friday. A crucifix, being ceremoniously unveiled, is laid on a cushion; the clergy and laity approach it with genuflections and kiss it. The choir sings the "reproaches," mostly taken from the fourth Book of Esdras, and includes a dialogue, the Trisagion hymn from the liturgy of St. John Chrysostom, repeated thrice, then an antiphon of adoration, followed by the hymn *Pange lingua gloriosi Lauream certamenis* with the refrain, "O faithful cross, O sweet wood." The priest and ministers then go in procession to return with the Blessed Sacrament for the Mass of the Presanctified.

**ADRENAL GLANDS**, two small endocrine glands situated one above each kidney. They consist of two parts, a central medulla and an outer cortex, which have different embryological origins and different functions. Though the cortex is perhaps essential to life, its exact mode of action is not understood. The medulla secretes epinephrine into the blood stream. (See **ADRENALIN**.) The active principle of the cortex has been recently discovered and a commercial preparation of it is known as **CORTIN**.

**ADRENALIN**, a proprietary name for epinephrine. Epinephrine (suprarenine), the active principle of the medulla of the **ADRENAL** (suprarenal)

**GLANDS**, whose specific action in the human body is to stimulate the sympathetic nerve endings. (See **AUTONOMIC NERVOUS SYSTEM**.) During normal activity epinephrine prevents undue relaxation of the blood vessels, thus maintaining normal blood pressure. During violent exercise it is secreted in large amounts. Epinephrine is a white, brownish crystalline powder,  $C_9H_{13}O_3N$ . When used in medicine it is generally in the form of solution of epinephrine. Injected intravenously, it causes a marked but fleeting rise of the blood pressure. It also slows the action of the heart and increases the output of sugar in the urine. It is inactive when taken by the mouth, but relieves paroxysms of asthma when sprayed into the larynx or injected hypodermically. In overdose the toxic effects are manifested by tremors, palpitation and uneasiness. It is applied locally to mucous membranes before operation to prevent bleeding, and when used with local anesthetics it prolongs their action. Epinephrine hydrochloride in solution of 1:10,000 to 1:1,000 parts of water is used locally in conjunctivitis, coryza, hay-fever, etc. See also **CORTIN**. P. N. L.

**ADRIAN**, a name as famous in ecclesiastical records as Hadrian in the annals of empire. St. Adrian (d. 710) was an African by birth and Abbot of Nerida, a Benedictine monastery near Naples. Pope Vitalian offered him the archbishopric of Canterbury which, in humility, Adrian refused, preferring to serve under Archbishop Theodore. For 39 years, as Abbot of St. Peter's, Adrian developed Canterbury as a seat of learning, influential in northern Europe.

Another Adrian, saint and martyr, was a Praetorian guard of the Emperor Galerius Maximian. Converted to Christianity, he was slain in 303 at Nicomedia, his limbs being cut from his body on an anvil, after which he was beheaded. With his wife, St. Natalia, he is the patron of soldiers, especially in northern Europe.

**ADRIAN**. There have been six popes of this name. Adrian I (772-795) was assisted by Charlemagne against the Lombards. Adrian II (867-872) rose to the chair of St. Peter at an advanced age. The statement is made that, in early youth before taking orders, he married and that his wife and daughter were kidnapped and disappeared.

Adrian IV, the only English Pope, was the protagonist in a struggle between Church and Empire for the emancipation of the Church from the Emperor. Born about 1100, at Langley near St. Albans, Nicholas Breakspear became Abbot of St. Rufus near Arles (1137), and a cardinal. In 1152 he organized the Norwegian archdiocese of Trondhjem and in 1154 was elected Pope.

Adrian V, created a cardinal by his uncle, Innocent IV, succeeded Innocent V but held the Pontificate only from July 5th to Aug. 18th, 1276, just long enough, in Dante's words, to experience "how great the mantle weighs." Adrian VI, born at Utrecht in 1459, was the tutor of the Emperor Charles V, who appointed him Inquisitor General of Aragon. Elected Pope in 1522, he faced the task of reforming a Papacy



challenged by Protestantism. In his attempt to regulate the sale of indulgences he was resisted by the cardinals, and as Leo X had mortgaged revenue for years from matrimonial dispensations his efforts to curtail these were also unsuccessful. After a brief reign, Adrian died in 1523.

**ADRIAN**, a manufacturing city in southeastern Michigan, the county seat of Lenawee Co., situated 33 mi. northwest of Toledo, O. It is served by the New York Central, the Detroit, Toledo and Ironton and the Wabash railroads. The local manufactures are highly diversified, and include paper, wire fences, electrical devices, screen doors, art goods and products of foundries, machine shops and railroad shops. The total value of manufactures for 1927 was \$11,330,448. In 1929 the retail business reached a total of \$10,074,735. Adrian College, a Methodist co-educational institution, St. Joseph's Academy for Girls (Roman Catholic), and the State Industrial Home for Girls are located at Adrian. Pop. 1920, 11,878; 1930, 13,064.

**ADRIANOPOLE.** See EDIRNE.

**ADRIANOPOLE, BATTLE OF**, 378, a battle between the Visigoths and the Romans. Four years earlier the Huns, an Asiatic people, reached Europe and attacked the semi-civilized German peoples in their path. The Ostrogoths were conquered; but the Visigoths, some of them Arian Christians, requested the permission of the Romans to enter the empire for protection. Valens, the Emperor, after some hesitation, consented, and in 376 they crossed the Danube. They lived peacefully at first; but the excesses of Roman officials, who robbed them and insulted their wives, incited them, after two years, to open rebellion. Advancing toward Constantinople, they met the Roman army near Adrianople and completely routed it, killing the Emperor himself. The victory was not prosecuted; but by peaceful penetration the Goths later acquired great importance within the empire.

**ADRIATIC QUESTION.** The question of control of the Adriatic littoral arose at the Peace Conference in Paris in 1919. Despite the fact that the Italian representatives at the conference insisted upon the fulfillment of the terms of the Treaty of London, between Italy and the Allies, of Apr. 26, 1915, President Wilson refused to consider himself bound by those provisions. The bitter dispute which seriously threatened the harmony of the peace delegates was settled on Nov. 12, 1920 by the Treaty of Rapallo. By this treaty Italy obtained Zara on the Dalmatian coast and the Istrian peninsula, despite its overwhelming Slavic population, but recognized Yugoslavia's rights to the remaining islands of the Adriatic which had formerly belonged to the Austro-Hungarian kingdom. The treaty also recognized the independence of Fiume, though subsequently Italy succeeded in acquiring that city.

**BIBLIOGRAPHY.**—R. W. Seton-Watson, *The Balkans, Italy and the Adriatic*, 1915; F. L. Bennis, *Europe Since 1914*, 1930.

**ADRIATIC SEA**, a branch of the Mediterranean, stretching from the Strait of Otranto to the gulfs of

Venice and Trieste, between Italy and Yugoslavia. Its length is about 480 mi. and its average breadth about 100. There are numerous rocky islands on the east coast, but the west coast is almost unbroken. The leading ports are Venice, Trieste, Fiume and Brindisi. The Adriatic receives numerous rivers and the Po is its principal tributary. Fisheries are important.

**ADSORPTION**, the concentration of substances out of liquid or gaseous mixtures on the surfaces of solids or liquids. Since the surface of a solid or liquid increases enormously with subdivision to colloidal dimensions, it is evident that adsorption is an outstanding feature of colloid chemistry.

A suspended solid best adsorbs a substance from liquids in which that substance is least soluble. A dye so strongly adsorbed by glass from water that it is difficult to wash off, is easily removed by washing with alcohol in which that dye is much more soluble. In general, it may be said that any substance that lowers interfacial tension or energy tends to concentrate at that interface. In a froth this concentration may take place on gas bubbles. In a certain sense, the froth concentration of copper sulphide from its powdered ores by oil flotation is an example of adsorption. The sulphide is adsorbed on the oily froth, while the silicious rock sinks in the water.

Negative adsorption occurs when the solvent rather than the dissolved substance is concentrated at the solid-liquid interface. The filtrate is then more concentrated than the original solution.

Adsorption is preferential, as is well shown in the selection of a certain ion from solution when other ions are present. Silver bromide precipitated in the presence of an excess of silver nitrate is positively charged because it preferentially adsorbs the positive silver ion rather than the negative nitrate ion. From an excess of potassium bromide, the silver bromide preferentially adsorbs the negative bromide ion and tends to remain in suspension as a negative colloid. Adsorbed ions tend to peptize or disperse the substance adsorbing them. A clay is made more plastic by adsorbed hydroxyl ions.

The adsorption of soluble fertilizing salts by soils is fortunate, for otherwise the loss in drainage water would be enormous. Porous carbons are much used to decolorize solutions, as in the sugar refinery. The cleansing action of soap is, in part, due to the adsorption of dirt particles at the extensive colloidal surface of the soap. The preferential adsorption of the needed food from the blood stream by different types of animal cells is a life-and-death matter to all of us.

The adsorption of certain vapors and gases by activated carbon is an important commercial process, while the adsorption of water vapor from gases by porous SILICA GEL is essential to one of the leading methods of drying gases. See also GAS ABSORPTION.

H. N. H.

**ADULT EDUCATION**, a term used in general to refer to such education, formal and informal, as is provided outside of the regular system of schools and

vocational schools and universities. It may range from courses for illiterate adults to lectures and courses provided under the auspices of universities, popular education societies, churches and other religious organizations, and associations of working-men and others. From some points of view it would include concerts, theaters, moving-pictures, museums, libraries and other agencies of a cultural and recreational character, as well as formal and informal gatherings in clubs and societies for cultural, social, political and economic purposes.

**Movement in 19th Century.** In the 19th century the term came to be applied to those forms of adult education which were established to supplement for the working classes the meager education of the elementary school and to provide during their leisure periods opportunities for education not otherwise available for them in the regular state systems of schools. Thus adult education had its origin in England in movements to ameliorate the conditions of the working classes due to the Industrial Revolution and was stimulated, on the one hand, by the evangelical movements, and on the other, by the movement for political and industrial democracy at the beginning of the 19th century. Out of the former grew such an organization as the National Adult Schools Union, which, while it is non-partisan and non-sectarian, assigns an important place to religion. Out of the latter there developed the mechanics' institutions, the Society for the Diffusion of Knowledge, working-men's colleges, people's colleges, and the educational activities of the Cooperative Movement.

In the United States the rise of the working classes to group consciousness was accompanied both by the creation of mechanics' institutions and the provision of educational opportunities by organized labor. For all classes there were made available opportunities for cultural and recreational activities by the rise of the lyceum (f. 1826) and the establishment of CHAUTAUQUAS on the model of the Chautauqua Institution started in 1874 by Bishop John H. Vincent. Similarly another form of adult education was provided by the UNIVERSITY EXTENSION movement which began in England in 1866 and in the United States in 1890. Out of this movement there sprang up in England a number of local universities and university colleges, and in the United States a widespread organization of educational facilities to reach all classes and all ages of adults through organized courses, lecture courses and home study courses.

The provision of facilities for adult education in England and the United States, although sufficiently varied, was sporadic and unorganized. The best example of adult education organized as a national movement was afforded by the Danish folk high schools, originating in the ardent desire of Bishop N. F. S. Grundtvig (1783-1872) to regenerate his country socially, politically and economically through an education that would bind all classes together on the basis of a common folk-culture. The first folk high school was established in 1844 at Rødning and

was immediately followed by others, which through reaching the adult population by an appeal to their own interests have contributed more to the prosperity of Denmark than the formal school system of the state. As a form of adult education the folk high school is characteristic of all the Scandinavian countries and Finland, and has been used as a model in England and Germany and in a very few instances in the United States.

**Great Britain.** The progress of adult education in general was not marked until the emergence of the working classes to self-consciousness in the present century and more particularly with the richer development of the concept of democracy since the World War. In England in particular was this progress marked with the rise of university tutorial classes and the organization of the Workers' Educational Association, both due to the remarkable ability and devotion of Albert Mansbridge. It was largely through his efforts that the character of adult education provided by a large variety of societies has achieved form not only in Great Britain but in the Dominions with short and long courses, week-end and summer courses, publication of books and student guides, creation of libraries, and resident courses. While the majority of the organizations interested in adult education aim to meet the intellectual interests of the working classes, the National Council of Labour Colleges bases its activities on the principle that education must be propagandistic and must be affected by the class struggle. The national importance of adult education was recognized by the Government in 1918 when a Committee on Adult Education was appointed, whose *Report* led to public financial support for the movement. In 1921 there was created the British Institute of Adult Education to serve as an agency for inquiry and research through cooperation with existing organizations. It publishes twice a year the *Journal of Adult Education*. This had been preceded three years earlier by the establishment of the World Association for Adult Education for "the development of adult education throughout the world and the federation in one association of individuals and institutions concerned with adult education in all countries."

**Germany and Russia.** In Germany the provision of adult education has made rapid progress since the War, largely through the establishment of independent organizations representing religious, political, educational and other interests. The effort made immediately after the War to promote cooperation between the universities and the working classes was not successful. As at present organized, the movement shows the influence of the workers' education in England and of the folk high schools in Denmark.

In no country can there be found so widespread an organization for adult education on a national scale as in Russia. Here every conceivable form of adult education, liquidation of illiteracy, cooperatives, trade unions, party groups, agricultural and industrial organizations, libraries, reading-rooms, the theater, the



cinema, radio—all are enlisted under the general supervision of the Political Education Section of the Commissariat of Education, the Agitational Propaganda Section of the Central Committee, or the Cultural-Educational Commission of all Soviets in directing adult education in the interests of political propaganda.

**The United States.** Although there is in the United States an extensive and varied provision of opportunities for adult education through the universities, Federal agencies, public school systems, Y.M.C.A., Y.W.C.A., correspondence courses, clubs, parents' associations and other kindred organizations, adult education among the working classes has not been widespread, partly because of the lack of availability of these opportunities, partly because they have not felt the pressure of the class struggle to the same extent as those in Europe. In 1921 the Workers' Education Bureau was established in New York and became the agent of the American Federation of Labor to act as a clearing house for adult education and to stimulate the creation of labor colleges, of which Brookwood College at Katonah, N.Y., is the outstanding example. Experiments have been undertaken at Bryn Mawr College and Barnard College in the organization of summer schools for working women. A large number of community organizations, urban and rural, have been established to organize, to coordinate, and to adapt education to the adult and his needs. Through the American Library Association the libraries of the country have been enlisted in the work.

The whole movement has been stimulated by an inquiry into various aspects of the problem initiated in 1920 by the Carnegie Corporation which led to a national conference in the following year and the establishment of the American Association for Adult Education in 1926 to collect and disseminate information concerning existing enterprises, activities and practices in adult education. The association publishes a *Journal of Adult Education*. An important stimulus was given to the progress of the movement by an investigation conducted by Prof. EDWARD LEE THORNDIKE as part of the inquiry of the Carnegie Corporation and reported in his *Adult Learning*, 1928. The general conclusion reached by Prof. Thorndike is that adults are virtually never too old to learn provided they have capacity, interest, energy and time. These, indeed, are the essentials. The failure of adult education in the past has been due to an attempt to provide courses based on an absolute concept of culture without any effort to discover the immediate interests of the learner, the immediate problems of his own life, and building on these. If ability to learn declines very slowly up to the age of 50, no individual need be deterred from pursuing those studies in which he may be interested, not as a form of vocational education in the narrow sense but in order that he may learn "how to enjoy life and how to use it to the full."

I. L. K.

**BIBLIOGRAPHY.**—The *International Handbook of Adult Education*, published by the World Association for Adult Edu-

cation, 1929, contains an account of the provisions for adult education in most countries of the world, directories of adult education organizations, and a full bibliography. Descriptions and bibliographies will also be found in the *Bulletins* of the World Association for Adult Education of which 32 have been issued from 1919-31.

**ADULTERATION, FOOD.** See FOOD ADULTERATION.

**ADULTERY**, generally speaking, voluntary sexual intercourse between two people, one or both of whom is married to someone else. Ordinarily, the crime of the married person is adultery, of the other, fornication. In some states, notably Massachusetts, both parties, though one be unmarried, are guilty of adultery. However, in other states, Connecticut for example, the act does not constitute adultery unless the woman be married. This obtains under COMMON LAW. In certain states, unless the woman knows that the man is married, it is not adultery. New York, Connecticut, Michigan and some other states have held that the admission of matrimonial cohabitation to prove marriage is not admissible evidence for conviction on charges of adultery. When parties to the crime are jointly indicted, the verdict in favor of one clears the other.

**AD VALOREM**, a term applied to a customs tax or duty (see CUSTOMS DUTIES) imposed on merchandise, as a certain percentage of the value of the commodity taxed as, for example, the 30% duty on imports of certain varieties of soap.

**BIBLIOGRAPHY.**—U. S. Printing Office, *Dictionary of Tariff Information*, 1924.

**ADVANCED BASE, NAVY**, an outlying temporary base used in war for the fleet or portions of it. Naturally it is located outside the continental limits of the United States.

**ADVENT**, a season of ancient but uncertain origin, which opens the ecclesiastical year. In the Eastern churches it consists of six weeks. In the Roman, Lutheran and Anglican churches the period is four weeks, beginning about St. Andrew's Day, Nov. 30, and so preceding Christmas for which it is a solemn preparation. The earliest record of Advent is associated with the Synod of Lerida, 524, where marriage during the season was forbidden. During Advent the Nuptial Mass and Benediction are not permitted in the Roman Catholic Church, and with regard to amusements it is the aim, in the words of the Anglican Collect, to "cast away the works of darkness and put upon us the armour of light."

**ADVENTIST CHURCHES**, a designation including the five Adventist bodies, sometimes called "Millerites," chiefly located in the United States. They had their origin in the teachings of William Miller (1782-1849), whose active ministry began in 1831 when he preached widely that Christ's second coming would occur between Mar. 21, 1843 and Mar. 21, 1844, basing his conclusions on certain passages in the Book of Daniel. In the beginning, the Adventists were members of the various existing churches, and it was not until 1845 that a separate church organization was planned. The disappointment over the

failure of the prediction relating to 1844 led Jonathan Cummings, one of Miller's associates, to announce in 1852 that an error in calculation had occurred and that 1854 would be the year of the great event. After this date brought its disappointment, the Adventists began to develop differences which eventually formed the separate bodies which exist to-day. The Second Adventists believe that death is a state of unconsciousness lasting until the resurrection, which will occur at Christ's return to the earth. They adhere to the two ordinances of the Lord's Supper and baptism by immersion. The Advent Christian Church was organized in Worcester, Mass., in 1861 and holds that no one knows when the advent will occur. The Seventh Day Adventists, who had existed since 1845, organized at Battle Creek, Mich., in 1860. The Church of God, Adventist, arose in 1865 under the leadership of Elder Cranmer at Marion, Iowa. In 1864 the Life and Advent Union was organized at Wilbraham, Mass., under the leadership of John T. Walsh, who preached that there would be no resurrection of the wicked. The fifth Adventist body is known as the Church of God in Christ Jesus, and was organized in 1888 at Philadelphia. It combined many independent Adventist churches known under various names such as "Brethren of the Abrahamic Faith" and "Restitutionists." The total membership of Adventist bodies in the United States was 141,727 in 1926.

**ADVERSE POSSESSION**, in law, the actual occupation of another's land, which if continued for a certain time—generally 20 years—gives an indefeasible right of possession to the occupant. The occupation must be open, notorious, continuous and adverse.

Trespass, the erection of a shanty, or fitful acts of ownership, such as erecting a lemonade stand for a day or two, do not constitute adverse possession. On the other hand, it has been held that the raising of one crop on land is sufficient to constitute adverse possession.

**ADVERTISING**, a process of fostering the sale of goods or services by means of public announcements and appeals to purchase. Advertising thus has two functions, that of giving information about the thing offered for sale, and that of inducing the customer to buy. In early times advertising was principally employed to disseminate information but recently, especially in the United States the use of persuasive appeals has been increasing.

Advertising in some form or other has existed since the beginnings of commerce and trade. Before the advent of printing, announcements of goods for sale were made by means of public criers, shop signs, such as the barber's pole, handbills and notices posted or painted on walls or other convenient surfaces. It was the printing press, however, that made possible the development of advertising on a large scale. The first printed advertisement in English, is said to have been an announcement of a book, the *Salisbury pye*, published by William Caxton about 1480. Soon newsletters, the fore-runners of the newspaper, began to

appear and advertisers quickly discovered the advantages of the new medium for telling their story. These early publications, however, were limited in number and in circulation. The real development of advertising did not occur until the nineteenth century, when, with the growth of the factory system new markets for products were demanded. With more and better publications, quicker transportation, mass production and distribution of goods, large scale advertising was inevitable. The fifty-year period from 1875 to 1925 saw a tremendous expansion in the use of this tool of competition. To-day it is conservatively estimated that in the United States one and a half billion dollars are spent annually for advertising. The National Bureau of Economic Research estimated that in 1927 about \$690,000,000 was spent for newspaper advertising, \$400,000,000 for direct advertising, \$210,000,000 for magazines, \$75,000,000 each for business papers and outdoor advertising, \$25,000,000 for premium advertising programs and directories, \$20,000,000 for street car cards, and \$7,000,000 for radio advertising. Expenditures of from two to four million dollars a year by individual companies are not exceptional. In spite of the size of these totals, however, appropriations usually average only two to five per cent of sales.

Opponents of advertising are accustomed to point out that the purchaser of an advertised product necessarily pays for this extra per cent. Wastes in advertising are cited. It is argued that advertising exploits the public, encourages foolish spending, is frequently untruthful, is unsightly and annoying, increases sales resistance by multiplying brands, adds to costs without adding to value and is therefore an economic waste. Supporters of advertising, on the other hand, claim that the small per cent of cost ascribable to advertising is justified as a necessary expense. They say that if advertising were not used some other form of selling effort would be required. It is claimed that advertising makes possible mass distribution which in turn makes possible large-scale production, with its resultant economies, so that advertising actually effects a saving to the consumer. It is also said that advertising acts as a guarantee of quality, makes possible speedy release of new inventions, helps stabilize prices, raises the standard of living, is educational and helpful. Economists tend to agree that advertising is an important tool of the modern competitive system and as such reflects the advantages and the evils of the system of which it is a part. H. K. N.

**BIBLIOGRAPHY.**—Frank Presbrey, *The History and Development of Advertising*; R. S. Vaile, *Economics of Advertising*.

**ADVERTISING AGENCY.** In modern business practice an organization of advertising experts rendering professional services to a group of advertisers. In the United States the pioneer agents (1840-1890) were simply brokers of advertising space in newspapers and magazines. To-day the typical agency assists the advertiser by studying the product to be advertised, analyzes the MARKET and methods of MARKETING,

suggests advertising media, prepares the plan of campaign, writes the copy and secures the illustrations, handles the mechanical details of preparation, contracts for space in publications and other media, forwards the advertisement to the publisher, checks and verifies insertion, audits the bills, and cooperates with the advertiser in sales work. Recognized agencies receive a commission, usually 15%, from the medium in which the advertisement appears. There are approximately 1,800 agencies in the United States of which about 130 are members of the American Association of Advertising Agencies. It is estimated that agencies handle 90% of all national advertising. *See also ADVERTISING MAN.* H. K. N.

**ADVERTISING ART**, a new and important phase of artistic development, has as its prime objective the selling of goods or services. It takes the form of drawings, paintings and photographs used as illustrations in newspaper, magazine and poster advertising, billboard displays, booklets and catalogues. None of the applied arts is more firmly based on the principles of psychology, and the idea is becoming firmly established in the minds of advertisers that the quality of the product or service to be sold must be represented by the quality of the advertisement which presents it to the buying-public. The standards have been raised to such a high level that many outstanding painters and illustrators work directly for advertising, or permit their signed work to be used in advertising media. Prices amounting to thousands of dollars have been paid for a single painting and millions of dollars are expended annually for art work alone in advertising. During 1930 approximately 18,000,000 drawings were used in the United States in connection with the one item of newspaper advertising. The effect of color on the reader is of paramount importance. Colors and color combinations are carefully used with regard to harmony, their power to arrest attention, or their peculiar fitness to represent the product to the public.

**ADVERTISING MAN**, one who publicizes wares and services. This occupation has been made necessary by mass production and the need for the largest possible markets. An advertising man should be enough of a psychologist to know what people want and need and how to employ the techniques of presentation so as to help the sale of his products or services. He needs to be a statistician, so that he may survey industry, analyze markets and appraise production, distribution and sales costs. He should be able to forecast future markets, perceiving new uses for a product or service and dramatizing them for prospective customers. As advertising counsel he is compensated by fees as is a **LAWYER**. But unlike legal counsel, the advertising man must gather about him an organization for carrying out the plans which he makes. This organization is called the advertising agency, through which he obtains compensation in the form of brokerage fees. The advertising agency man is the connecting link between the advertising manager in the office of a merchant or manufacturer

and the advertising solicitor, who represents magazines and newspapers. As an individual the advertising man is conducting field investigation, industrial research, writing "copy," making sketches for "layouts," buying space in magazines, newspapers, billboards, car cards, or time on the radio, conferring with clients, or soliciting advertising from agencies and their clients. It is a comparatively new profession in which cumulative experience counts heavily and requires the fundamental characteristics of a highly competent **SALESMAN**. R. PL.

**ADVISORY COUNCIL, NAVY**, a body composed of the Assistant Secretary of the Navy, the Assistant Secretary of the Navy for Aeronautics, the Chief of Naval Operations, the Chief of the Bureau of Navigation, the Chief of the Bureau of Ordnance, the Chief of the Bureau of Engineering, the Chief of the Bureau of Yards and Docks, the Chief of the Bureau of Supplies and Accounts, the Chief of the Bureau of Medicine and Surgery, the Chief of the Bureau of Aeronautics, the Major General Commandant of the Marine Corps, the Judge Advocate General of the Navy and the Budget Officer of the Navy.

The various subjects under cognizance of the bureaus that are of interest to any other bureau or are of general interest are submitted at these conferences. The Secretary himself generally presents Congressional and, particularly, budget matters.

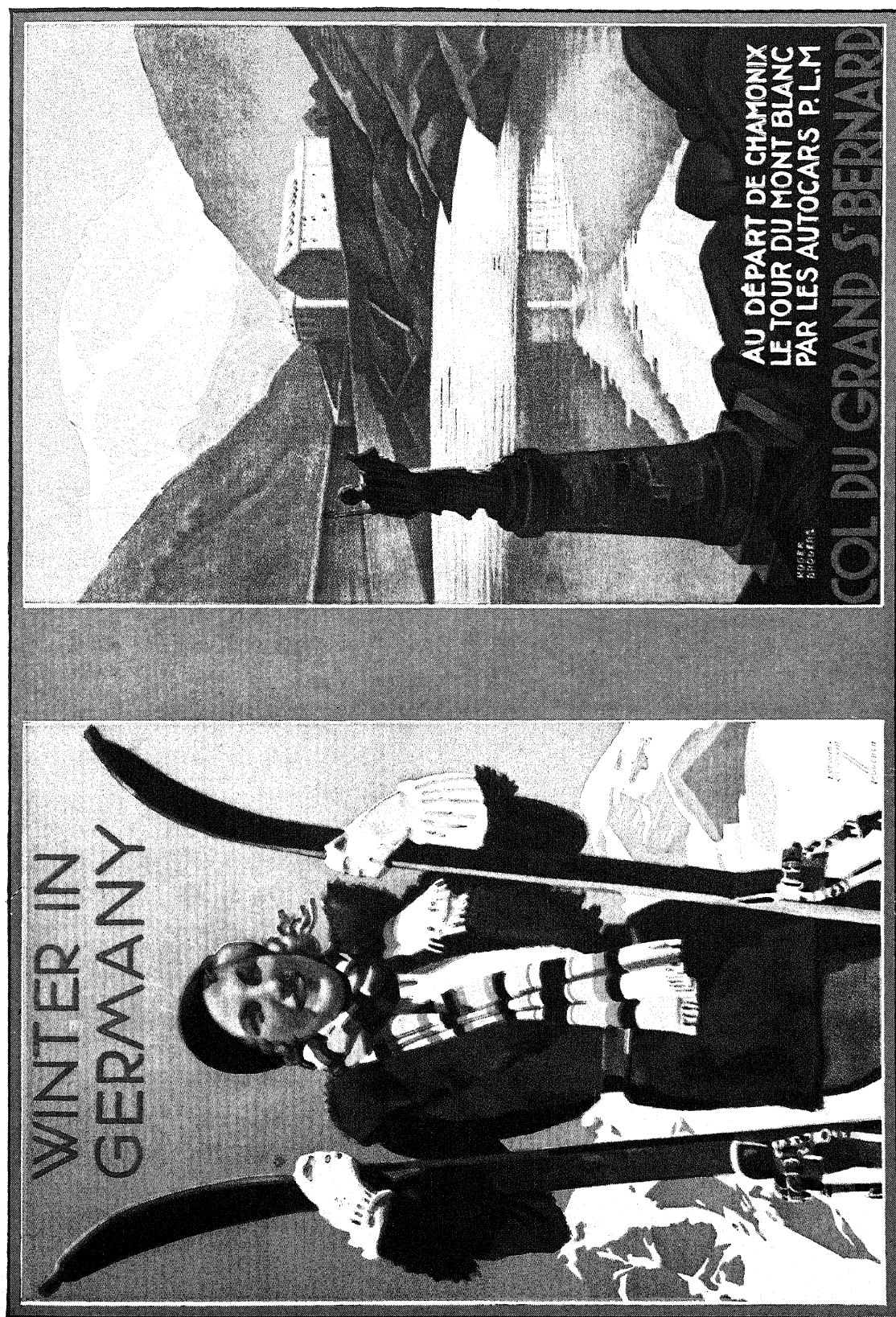
**ADVOCATUS DIABOLI**, or devil's advocate, the ecclesiastic in the Sacred Congregation of Rites at Rome who presents in writing all objections he can find to the proposed **BEATIFICATION** or **CANONIZATION** of a saint.

"Æ," pen name of the Irish poet, **GEORGE WILLIAM RUSSELL**.

**AEACUS**, a Greek hero who was made judge of Hades, when he died, because of his just rule of the **MYRMIDONS**. (*See MINOS*.) In works of art Aeacus carries the scepter and key of Hades. *See* **ACHILLES**.

**AEGEAN CIVILIZATION**, the term given to that civilization which extended over Greece, Asia Minor and the Aegean islands during the Bronze Age, flourishing from about 3500 to 1000 B.C. H. Schliemann, whose epochal archaeological researches first revealed to the modern world the existence of this culture, named it Mycenaean in the belief that it had its origin in Mycenae. However, excavations in Crete, particularly those of Sir Arthur Evans begun in 1899, have brought forth conclusive proofs that this island was the source and early center of the culture which Evans called Minoan after Minos, the fabled king of Crete. To-day, both the Minoan and Mycenaean periods, representing the early and later phases respectively of the same civilization, are included in the comprehensive term Aegean. The chief sites thus far explored are Cnossos in Crete, Hissarlik (Troy) in Asia Minor, Mycenae and Tiryns on the Greek mainland, and the Islands of Cyprus and Rhodes.

Late Neolithic remains dating back at least to 4000 B.C. have been unearthed in Crete; but evidences of a distinct culture appear only after the introduction



PRESENT DAY EUROPEAN POSTER DESIGN

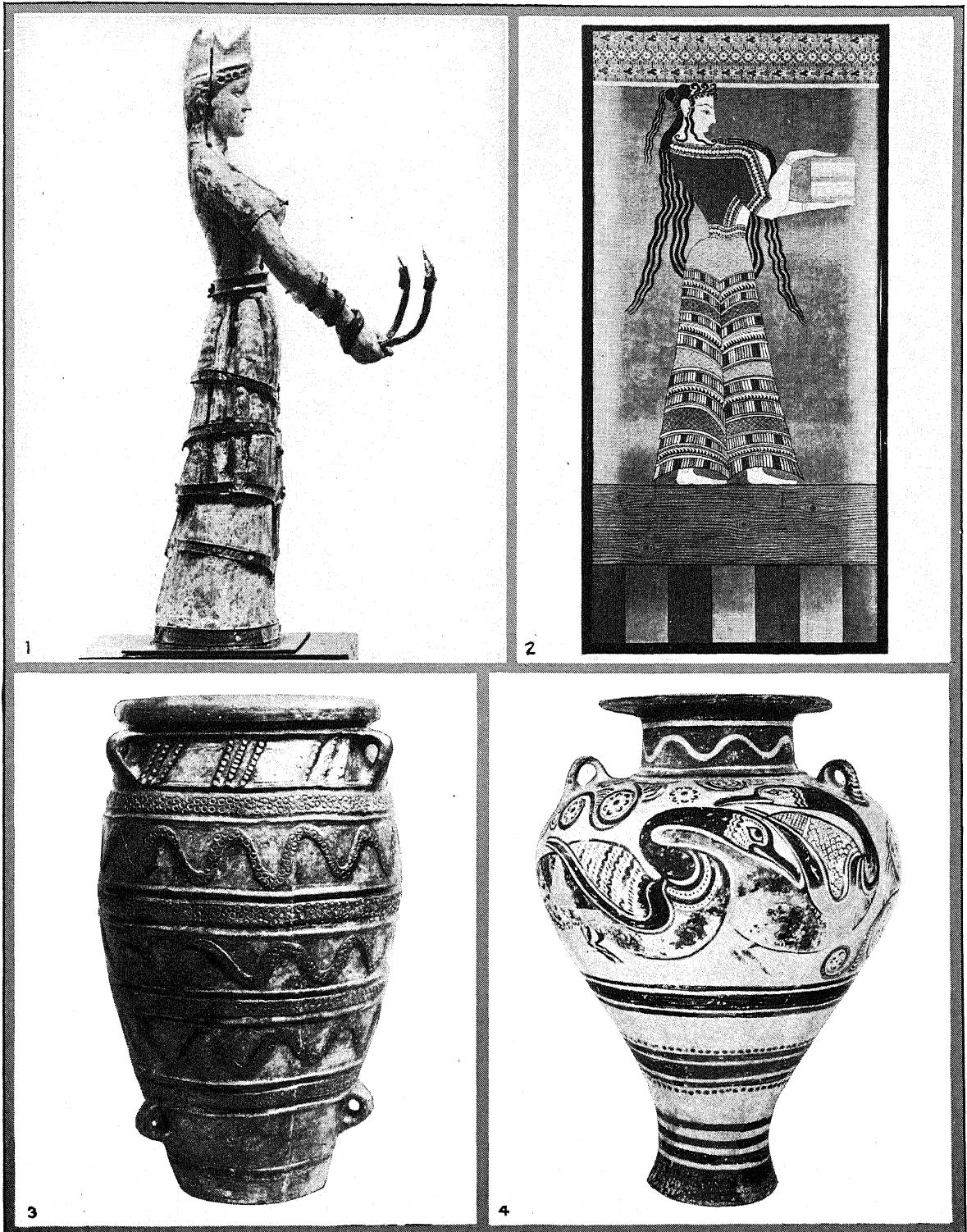
A German commercial poster.

A modernistic French poster.





## AEGEAN CIVILIZATION



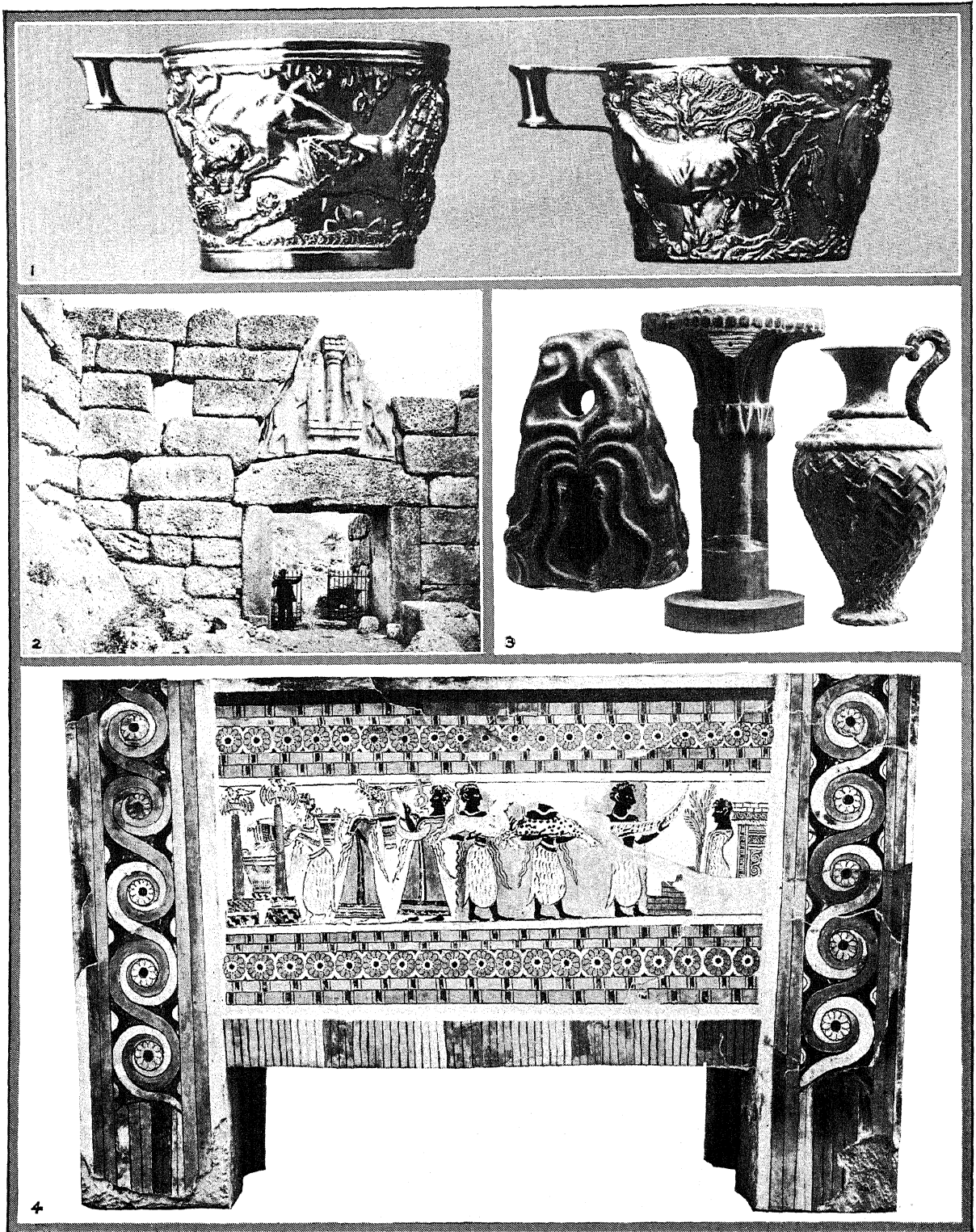
1. COURTESY MUSEUM OF FINE ARTS, BOSTON; 2, 3, 4. METROPOLITAN MUSEUM OF ART

### AEGEAN ART IN THE MINOAN AGE

1. Statuette of the Minoan snake goddess of Crete, 16th century. 2. Fresco of a woman carrying a casket, late Minoan III Period (1350-1100 B.C.), found at Tiryns. 3. Reproduc-

tion of a large pithos, or vase, of the middle 3rd century B.C. Cretan original in the National Museum, Athens. 4. Minoan vase dating from 1600-1400 B.C.

## AEGEAN CIVILIZATION



COURTESY METROPOLITAN MUSEUM OF ART

### VARIOUS EXPRESSIONS OF AEGEAN ART

1. Mycenaean Vaphio gold cups. 2. Gate of the Lions at Mycenae, showing sculpture. 3. Stone lamp, weight and pitcher, Cretan, about 1500-1100 B.C. 4. Side of a painted sarcophagus of about 1350 B.C., Hagia Triada, Crete.

of bronze several centuries later. Remains of ruined palaces, tombs, villas and fortifications, furniture, fabrics, articles of personal adornment, tools and weapons, sculptures, and inscriptions have enabled archaeologists to trace its steady progress. By the middle of the 3rd millennium B.C., Crete was already launched as a great sea power, trading extensively with Egypt and other Mediterranean countries. The island apparently was governed by several rulers unified, for a time at least, under one head. Cnossos was the seat of the strongest dynasty. From the religious relics found in palaces, together with the absence of separate temples, one may infer that the kings acted also as high priests. A fetishistic form of nature worship was the prevailing religion. Centuries of peace and prosperity gave the Cretans ample opportunity to develop their arts. The great palace at Cnossos, rising story upon story, had its walls frescoed with magnificent animal and plant designs, and was equipped with bathrooms having a very efficient drainage system. This vast and complex structure was probably the original Minoan Labyrinth of Greek legend. Aegean art found its finest expression in pottery. The brilliantly



FAYENCE SNAKE GODDESS OF THE MIDDLE MINOAN PERIOD

colored glazed vases of the Aegeans rank among the most beautiful in the world. Wall-painting, sculpture, glyptics, inlaid and engraved metal work and jewelry making were also highly advanced arts. The Aegeans possessed a system of writing which has not yet been deciphered.

The apogee of Aegean civilization in Crete was reached in the 17th century B.C. About 1400 B.C., the palaces of Cnossos and other Cretan cities were destroyed in an unknown manner. A renaissance followed this catastrophe, but Cretan culture never regained its former magnificence and vigor, and about 1000 B.C. it disappeared entirely. Throughout the 2nd millennium, the Aegean civilization had spread from Crete to neighboring countries. On the Greek mainland it found its chief centers in Mycenae and Tiryns, where the height of its influence was felt between the 15th and 12th centuries B.C. At Mycenae are the royal "bee-hive," or vaulted, tombs, in one of which Schliemann supposed he had found the bodies of Agamemnon and his followers. Mycenaean civilization abruptly disappeared about the end of the 12th century, at which time Mycenae, Tiryns and other

strongholds were burned down. The Homeric epics contain valuable descriptions of Aegean life and customs.

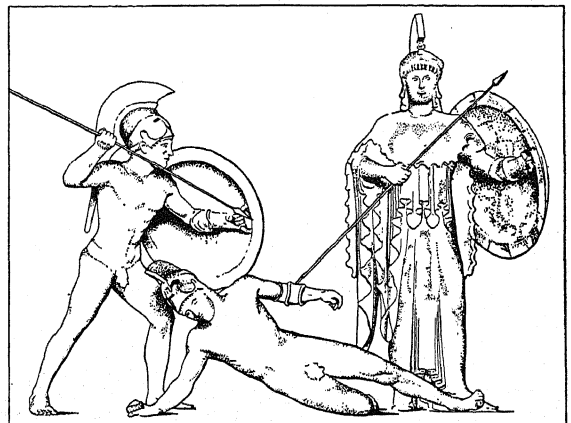
A. DE.

BIBLIOGRAPHY.—H. Schliemann, *Mycenae*, 1878; Sir A. J. Evans, *The Palace of Minos*, 1921-30, *The Shaft Graves and Bee-hive Tombs of Mycenae and Their Interrelation*, 1929; V. G. Childe, *Dawn of European Civilization*, 1925; G. Glotz, *The Aegean Civilization*, 1925.

**AEGEAN SEA**, the name given by the ancients to the eastern part of the Mediterranean. It is also known as the Greek Archipelago, but of recent years the ancient name has been revived. The Aegean Sea is situated between Greece and Asia Minor and the Dardanelles connects it with the Sea of Marmora and the Black Sea. It is thickly strewn with islands, most of which belong to one or the other of the two groups known as CYCLADES and SPORADES. Some of these islands are the result of volcanic action and practically all are extremely fertile. The inhabitants are strong and handsome, and the women particularly are pure Greek in type. At present, some of these islands are claimed by Greece while others are under the rule of Turkey. Many of them are extremely fertile and produce grain, wine, olive oil, citrus fruit, live stock and dairy products in addition to the sponge fisheries.

**AEGEUS**, the father of THESEUS.

**AEGINA**, a Greek island in the Saronic Gulf. The chief town on the island has the same name. The island is about 40 mi. sq. The Dorians drove out the original settlers and built up a flourishing trade. The island is said to be named for Aegina, the mother of Aeacus who ruled there. The west side of the island is fertile, the rest too rocky for cultivation. Sponges, wheat, wine and cotton are the principal products. The climate is dry and healthy. The chief interest is in the temple at the north end which was thought to be a temple to Zeus, but more recent excavators attribute it to Aphaea, a local divinity. Many beautiful sculptures have been found there and the plan of the temple is extensive.



ATHENA AND WARRIORS, WEST PEDIMENT, TEMPLE OF AEGINA

**AEGINETAN SCULPTURE.** Aegina, in early times, was celebrated throughout Greece for its school



of skilled sculptors, among them the renowned masters Callon, Onatas and Anaxagoras, all of whom flourished about the 5th century B.C. Excavations of a temple to the Aeginetan goddess Aphaea, or perhaps to Athena, brought to light many important pediments representing athletes fighting over the dead bodies of their companions. These were restored by the sculptor Thorvaldsen and set up in Glyptothek at Munich, Bavaria.

**AEGIS**, a Greek word, meaning goatskin. ZEUS, or Jupiter, wore the hide of Amalthea, the goat, which had fed him in his infancy. This protection, which included the head of a Gorgon, enabled the god to conquer the TITANS. The aegis thus became a recognized element in the armor of the Olympians, being roughly describable as a breastplate. Hence, the modern word which signifies protection.



AEGIS

Athena Parthenos,  
National Museum,  
Naples

**AEGOSPOTAMI**, or **AEGOSPOTAMOS**, a small stream emptying into the Hellespont north-east of Sestos. There was probably a town there in the 4th and

5th centuries. It was at the mouth of this river that Lysander defeated the Athenians in 405 B.C. and ended the PELOPONNESIAN WAR.

**AELFRIC** (c. 955-1020), Anglo-Saxon writer, known also as "the Grammarian." Little is known of his career, but authorities agree that he was a monk in the Old Monastery of Winchester and later abbot of the newly-founded monastery of Eynsham, near Oxford, where it is believed he remained until his death, about 1020. He is the author of *Homilies in the Anglo-Saxon* as well as a translator of the Holy Scripture and a writer of force upon miscellaneous subjects. In his *Homilies* Aelfric denies the Immaculate Birth of the Virgin. Because of this and his views on the Eucharist he became involved in a controversy with ecclesiastic authorities.

**AEMILIA VIA** or **AEMILIAN WAY**, a high road made by Marcus Aemilius Lepidus in 187 B.C. during his consulship. It ran for about 176 mi. between the River Po and the Apennines, continuing the Flaminian Way from Ariminum, the modern Rimini, to Placentia, the modern Piacenza. Parts of the road are still in use and it has many beautiful bridges, old and new.

**AENEAS**, a Trojan hero. The goddess APHRODITE frequently inspired other divinities on Olympus with a love for mortals. ZEUS, therefore, condemned her to be infatuated herself with ANCHISES, great-grandson of Tros, founder of Troy. The boy Aeneas was born on Mount Ida, and brought up at Dardanus. He was out of sympathy with PRIAM, King of Troy, his cousin. While tending his flocks, Aeneas was attacked and robbed of his cattle by ACHILLES and for this reason joined HECTOR in the defense of the city against the Greeks during the siege of Troy,

where he displayed great courage. When DIOMEDES hurled a stone at him which broke his hip, Aphrodite hastened to his assistance and was herself wounded. APOLLO then rescued Aeneas, who was tended in the temple by LETO and ARTEMIS. According to Roman tradition, he escaped from captured Troy bearing Anchises on his shoulders and leading his son, Ascanius, by the hand. His adventures are the subject of the *AENEID* of Virgil, intended to prove the divine origin of the Roman people under Augustus. This poem ranks with the *Iliad* and *Odyssey* of Homer as one of the supreme epics of literature. The first six books are devoted to the wanderings of Aeneas. He was driven into the arms of Dido at Carthage, buried his aged father, Anchises, in Sicily, and, anticipating Dante's journey through the Inferno, visited his parent in the lower world. Finally Aeneas and his Trojans landed in Latium, then a kingdom in Italy ruled by Latinus, a name perpetuated in the word "Latin." Received at first with suspicion, the Trojans won the confidence of Latinus, whose daughter was Lavinia. She had been betrothed to Turnus, King of the prehistoric Rutuli, but Latinus bestowed her upon Aeneas. The result was a war in which both Turnus and Latinus were killed. Aeneas thus became ruler of Latium but was attacked by the Rutulians and their ally, Mezentius, King of the Etruscans, who had been exiled for his cruelty. The accounts of these hostilities are confused. Aeneas is said to have slain Mezentius. On the other hand, he was himself killed and his body was never recovered.

**AENEID, THE**, a Latin epic in 12 books by VERGIL (1st century B.C.). This superb national poem stands in relation to imperial Rome as do the Homeric epics to early Greece, and ranks as one of the world's three or four epic masterpieces. Aeneas, hero of the poem and the traditional founder of Rome, was the son of Anchises and Venus, and appears as a minor hero in THE ILIAD. It was his destiny, of which he was warned by Hector in a dream, to set forth at the fall of Troy with a fleet of 20 ships, to wander for seven years through superhuman perils, to land at last at the Tiber's mouth, the future site of Rome. The first six books of the epic narrate the exciting history of these wanderings and contain the famous episodes of the fall of Troy, the love and tragic death of Dido, Queen of Carthage, the funeral games in Sicily, Aeneas's descent into the underworld, where he learns the future of Rome and of the Julian family, and, finally, his landing in Latium. The last six books deal with the hero's wars with Etruscan and Latian enemies, his marriage with Lavinia, and, at the last, set the stage for the future greatness of Rome.

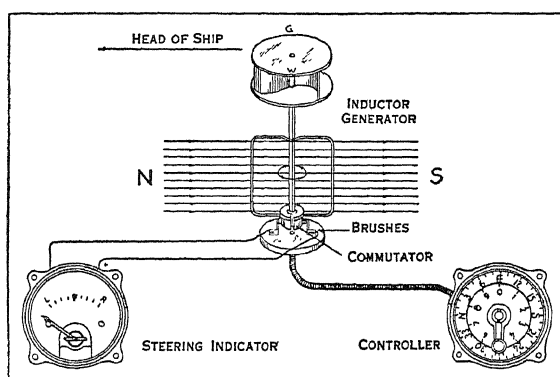
**BIBLIOGRAPHY.**—Standard edition by J. Conington and H. Nettleship, 4th ed. 1881-83; verse trans. by John Dryden, 1697; prose trans. by J. W. Mackail, 2nd ed. 1908; J. R. Green, *Stray Studies*, 1876; J. Henry, *Aeneidea*, 1873-79.

**AEOLIAN DEPOSITS**, Accumulations of wind-blown soil materials. Vast quantities of miscellaneous earth-dust, picked up in arid regions, are carried by

the winds. Heavy sand-particles are dropped first, forming dunes in deserts or along sea shores. Finer wastes travel further, settling in protected basins where the air tends to stagnate. Deposits of volcanic ash, 30 ft. deep, are found in Nebraska, hundreds of miles from any volcano. On the great dust-plains of North-western China lies a layer of strange yellow loam, called *loess* hundreds of feet thick. Like the loess of the Mississippi Valley, this is of aeolian origin.

**AEOLUS**, the god of the winds which, according to Homer, he kept in a bag, though Virgil mentions a cave as the receptacle. The six sons and six daughters of Aeolus are supposed to represent the 12 months. An Aeolian harp yields music to the passage of wind. Another divinity of that name was regarded as the mythical founder of the Aeolian or Greek race.

**AERIAL COMPASS**, a compass showing the direction in which an AIRCRAFT is headed. In its most usual form, it is identical with a ship's compass, consisting of a magnetic element, a card and a pivot, supported upon a jewel bearing and contained in a bowl of liquid. The earth inductor compass utilizes



COURTESY PIONEER INSTRUMENT CO

EARTH INDUCTOR COMPASS

The controller is set on the desired direction and the pilot steers to maintain the indicator in the center position. In this illustration, the controller is set for East. The indicator shows that the plane, moving northward, is left of the desired course

the reaction of coils of wire rotated in the earth's magnetic field to generate electric potential which indicates, at a distance, departure from a predetermined course. A compass operating on the principle of the GYROSCOPE is also used.

**AERIAL LAW**, the law or rules regulating the use of the air above the sea and above a state's territory, including its Territorial Waters. It was once urged that the air was free, and that states had in war and peace only such rights as were necessary for their preservation. The more correct principle is that the state has SOVEREIGNTY over the aerial space above its soil, save the right of innocent communication and passage. The Convention for the Regulation of Aerial Navigation, Oct. 19, 1919, regulates and lays down the general principles of aerial navigation. Sovereignty of the state over territory and territorial waters is freely admitted. Regulations are set forth as regards prohibited areas, the nationality of aircraft,

the skill of pilots, licenses, airworthiness of aircraft, certificates, landing and passage through the air-space of a state without landing. This has been signed by 15 states, and is administered by an International Commission for Air Navigation. C. E. MA.

**AERIAL MAPS**, graphical representations of an area showing features of concern to an aircraft pilot. They were first compiled for the use of the Army, and showed the model airways of the country. Later, similar strip maps of the coast showing marine aids, anchorages, landmarks and air routes contiguous to the coast, were published by the HYDROGRAPHIC OFFICE. Under the Air Commerce Act of 1926 the DEPARTMENT OF COMMERCE was charged with the charting of civil airways, and has undertaken this work through the COAST AND GEODETIC SURVEY. Strip maps of principal lighted airways, and sectional maps, 6° in longitude by 2° latitude covering the U.S., are in preparation.

The civil airways are shown by magnetic bearings and by the mileage numbers of beacon lights. Sketches of airports and intermediate landing fields are shown on the reverse side of the maps. In addition to geographical features, cities, roads and railways, the maps show aeronautical lights, landing fields, radio range beacons and airways weather reporting stations. F. C. HI.

BIBLIOGRAPHY.—Department of Commerce, *Aeronautic Bulletin* No. 10.

**AERIAL NAVIGATION**, or avigation, the science of directing an AIRCRAFT to a predetermined point. It is usually divided into three divisions, namely: Pilotage (*see* AIRSHIP PILOTING; AIRPLANE PILOTAGE), DEAD RECKONING, and Celo-avigation. Pilotage refers to finding one's way by recognizing or identifying, on the map, natural or artificial land marks such as mountains, shores, rivers, railroads and towns. Dead, or deduced reckoning deals with the determination of direction and of distance covered. It involves the use of the COMPASS and sighting devices for measuring the speed with respect to the earth by sighting on a fixed point. After the "true" heading is obtained by correcting the compass, allowance is made for the effect of the wind to determine the airplane's direction with respect to the ground (*see* DRIFT INDICATOR). With direction and distance plotted from the starting point, the location of the airplane at any instant is determined.

*Celo-Avigation*, or astronomical position finding, is the same in principle as maritime NAVIGATION. By measuring the angle of altitude of any certain heavenly body an observer may locate his geographical position at some point on a defined circle whose center is the sub-solar or sub-stellar point and whose radius in degrees is equal to the angular amount the celestial body is from the observer's zenith. If the observed angle of altitude and the angle of altitude calculated for the dead reckoned position differ, the avigator knows his position is toward or away from the sub-solar or sub-stellar point by an amount equal to this difference. This difference is measured from the dead

reckoned position along the azimuth radius of the observed body. The observer's position will be on the circumference of the circle through the last point. The true position may also be determined by measuring the altitude of a second celestial body and plotting the circle about its zenith, the position of the observer being at a point where this circle intersects the first. In practice, straight lines tangent to the circles are plotted on maps or charts instead of the circles, which are too large. In celo-avigation operations accurate time must be available as well as a nautical almanac giving the location of the celestial bodies. A. F. HE.

BIBLIOGRAPHY.—B. Jones, *Avigation*, 1931.

**AERIAL PHOTOGRAPHY**, the art of securing photographs from points above the earth's surface. The photographs are taken from an AIRPLANE or airship flying above the objects to be photographed. The elevations from which photographs are taken may vary within wide limits, depending upon the size and type of photograph required. Few photographs are secured from elevations under 500 feet because of the hazards of operating aircraft at low altitudes, and a few are secured at elevations of 20,000 to 30,000 feet from aircraft specially equipped for high-altitude flying.

Military air forces attach great importance to their photographic divisions. The photographs are used to locate enemy defenses and to map enemy territory. Aerial photography is used extensively in civil activities in compiling maps, being employed by geologists, locating engineers and hydraulic engineers. Recently, it has been used by archeologists in the location and mapping of ancient ruins. See SURVEYING, AERIAL. The oblique or air-view type of aerial photograph is used by newspapers, book publishers and advertisers to illustrate their copy. Although complete statistics are not available, competent authorities estimate that several million dollars are expended annually for aerial photographs in this country alone.

There are a number of fully equipped commercial aerial-photography laboratories. Some are equipped with elaborate optical instruments for the purpose of producing contour maps directly from aerial photographs by stereographic methods. In 1929 the DEPARTMENT OF THE INTERIOR published a complete list of books on photo mapping. S. M. F.

**AERODYNAMICS**, that branch of HYDRODYNAMICS which deals with the effects of forces acting between the various parts of a gaseous medium, or between such a medium and solid bodies with which it is in contact. These forces, aside from those caused by static pressure, are due to the relative motion of the gas, or air, and the solid body. They are the same for a solid moving through still air as for the same solid exposed to an air current of equal velocity. They arise from the fact that air, or any other gaseous substance, has INERTIA, ELASTICITY and VISCOSITY. As a result of the inertia of air, a force is required to set it in motion, to stop it, or to change the direction of its motion. Elasticity sets up forces tending to cause a flow in the direction of lower

pressure, and viscosity causes forces which oppose the existing motion.

The applications of aerodynamics lie in two quite different fields but the principles involved are the same in both. The dynamics of the atmosphere is a branch of METEOROLOGY dealing with the circulation of air above the earth. Winds have been used as a source of power since ancient times. This field includes the applications of WINDMILLS, sailing vessels and the FLETTNER MOTOR. The second, and more important modern application has to do with the dynamics of flight, particularly that of heavier-than-air machines. See AIRPLANE.

In the case of windmills it is important to know the power of an air stream. When the wind velocity,  $v$ , is in miles per hour, the horsepower, represented as  $0.0000075 v^3$  per square foot.

In all other cases the pressure exerted by a moving stream of air is the important factor. If a stream of air moving with a speed of  $v$  miles per hour could be brought to rest by impact on an obstacle in its path, it would exert a pressure of  $0.0052 v^2$  pounds per square foot. Since the air is never brought to rest the actual forces are less than those given by the formula and depend upon the form and size of the obstacle. For square plates exposed at right angles to the air stream, the forces are about  $3/5$  those given by the formula. In the case of surfaces inclined at an angle to the air current, such as the wings of airplanes, the forces must be computed from data obtained from experiment under similar conditions. See WIND TUNNELS. Thus, the theoretical equations of hydrodynamics are of little direct value in the computation of forces on airplane members and are merely guides toward an ideal. Such equations apply only to the simpler cases of stream line flow in which the air is supposed to flow past the solid without turbulence and without producing changes in the static pressure. In practice there is usually a tendency to produce a partial vacuum behind the moving body thus setting up a static pressure which must be added to the pressure due to change of momentum.

In aircraft design (see also AIRPLANE DESIGN) theoretical aerodynamics substitute a frictionless fluid for air and the calculated aerodynamic motion and forces must be corrected for the influence of air friction. This correction is small, because aircraft are shaped for small air friction.

Theory accounts well for pressure and lateral forces on AIRSHIP hulls, for lift and its distribution on wings and tail surfaces, for air propeller (see PROPELLER THEORY) thrust and for a portion of the wind drag, or induced drag, and slipstream torque. However, there is always friction drag and torque that is not accounted for by theory, and all attempts to understand or compute in detail, the motion of air under the effect of mass and friction forces have so far failed. See also AIRSHIP DESIGN. A. A. K.

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**AEROLOGY**, the special designation for the part of the science of METEOROLOGY that deals with the control exercised over weather by the laws of physics, chemistry and dynamics. The essential differences between the sciences is that aerology is concerned entirely with experiment at the personal control of the operator, and meteorology is concerned with experiments which can be used only to illustrate and account for observation. The field of aerology includes the upper air as well as the lower, but the term is frequently used as limiting the study to the upper air.  
R. E. C.

**AEROPLANE.** See AIRPLANE.

**AEROSTATICS**, that branch of AERODYNAMICS having to do with the forces exerted by bodies of gases at rest, and in particular with the forces which the air exerts upon bodies submerged in it. These forces result from the fact that air has weight. They are proportional to the barometric pressure in inches, *B*, and to the area in square inches, *A*, upon which they act. They act at right angles to the bounding surfaces and at any given point are equal in all directions. The force *F*, in pounds, acting on any area, is given by the equation

$$F = \frac{AB}{2.04}$$

An important example in aerostatics is demonstrated by the lifting forces acting on balloons. In accordance with the principle of ARCHIMEDES a fluid exerts, upon any body submerged in it, an upward force equal to the weight of the volume of fluid displaced by that body. The effective lifting force is equal to the difference between this upward force and the weight of the body itself. Thus the net lifting force acting on a balloon weighing *W* lbs. and containing *V* cu. ft. of gas is

$$F = V [\text{density of air} - \text{density of gas}] - W$$

and the balloon will rise, remain in equilibrium or fall according as this is greater than, equal to or less than zero.  
A. A. K.

**AEROTHERAPEUTICS**, the treatment of disease by fresh air, by air of different degrees of pressure or rarity, or medicated air. An abundance of fresh air is beneficial in infections and pulmonary conditions. The rarefied air of high altitudes is beneficial for tuberculosis and early heart disease, while lower altitudes benefit nephritis. Arrangement is often made to filter the air entering the sleeping rooms of asthmatics to free it of pollen (see ALLERGY). The vapors of drugs are frequently used to treat disorders of the respiratory tract.

**AESCHINES** (389-314 B.C.), Athenian orator, was born in 389 B.C. and died at Samos in 314 B.C. He was twice an envoy to PHILIP OF MACEDON, who was seeking to subjugate the Greek states, and was twice accused by DEMOSTHENES, his political antagonist, of accepting bribes from Philip. Aeschines in turn brought Ctesiphon to trial for proposing a golden crown for Demosthenes as a reward for his eloquence. Demosthenes championed Ctesiphon successfully and

Aeschines was compelled to retire from Athens. He established a school of eloquence in Rhodes. Among his orations, *Against Timarchus*, *On the Embassy* and *Against Ctesiphon* are still extant.

**AESCHYLUS** (c. 525-c. 456 B.C.), Greek poet and tragedian, was born at Eleusis about 525 B.C. His career as a writer of plays was interrupted at intervals by his participation in the Greek wars against the Persians, and his presence at the great battles of Marathon, 490, Salamis, 480, and Plataea, 479, undoubtedly had a share in the development of his genius along heroic lines. Although he took part in the tragic contests at the age of 26, he failed to win a first prize until he was 41. He was the victor, however, a dozen times thereafter, and is recognized as the real founder of the Greek drama. Through him dramatic dialogue was introduced, as he was the first to employ a second actor on the stage, in addition to the traditional chorus. He is known to have taken part in his own plays. On the last of several visits to Sicily, where his plays were greatly esteemed by King Hiero, Aeschylus died and was buried with suitable honors at Gela, on the site of Terranova di Sicilia, in 455 or 456 B.C. He is generally considered the greatest of the Athenian writers of tragedy because of his lofty ideals, his profound interest in the mystery of human fate, and the masterly way in which he sustains the suspense as the tragedy develops. Of more than 70 plays by Aeschylus, only seven are preserved in their entirety. These include *Prometheus Bound*, *The Seven Against Thebes*, *The Persians*, *The Female Suppliants* and, towering above the rest, the trilogy known as the *Oresteia* (the story of Orestes and his mother Clytemnestra) which includes *Agamemnon*, the *Choëphorae* (The Libation-Bearers), and the *Eumenides*. This majestic drama of crime, revenge and punishment by the gods, the last work of the dramatist, is the most sublime example of his genius. It is considered one of the great masterpieces of all time.

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**AESCULAPIUS**, the Greek god of medicine. He was the son of Apollo and the nymph Coronis. Aesculapius was credited with restoring the dead to life and Zeus, fearing that men might become immortal, slew the physician by lightning. At Apollo's request Aesculapius was included among the stars. The symbols of Aesculapius were a staff and a serpent clinging around it, which recalls the legend that he derived a medicinal herb from a serpent's mouth. His daughter was Hygieia, from whom we have the word "hygiene." She is represented with a serpent which she feeds from a cup. She was the protectress both of physical and mental health.

**AESIR**, the name of the principal or ruling gods in Norse mythology. They are said to be representatives of life, order and progress in contrast to the Jotuns, who typify confusion, desolation and death. Among the Aesir are reckoned 12 gods, Odin, Thor, Balder, Niord, Frey, Tyr, Bragi, Heimdall, Vidar,

Vali, Ullur and Forseti. There is an equal number of goddesses. Their dwelling place is called Asgard, which is a vast fortress enclosing the mansions of the gods and goddesses.

**AESON**, the father of JASON.

**AESOP** (620-560 B.C.), ancient fabulist, is believed to have been born of Phrygian parents about 620 B.C. He was said to be a slave of Iadmon of Samos. Later he lived at the court of Croesus and dined in the company of the SEVEN SAGES of Greece at Corinth. In the reign of Peisistratus, Aesop visited Athens and there recounted the fable about "The Frogs Asking for a King," which was meant to dissuade the Athenians from deposing Peisistratus for another ruler. The stories attributed to Aesop are from a collection made by Maximus Planudes, a monk of the 14th century, and are based on the Latin adaptations of Babrius, Phaedrus, Avianus and others. Planudes added in this book fables from Oriental sources. Many of the current *Fables* are spurious, and some scholars even deny the existence of Aesop. The fabulist is supposed to have died at Delphi in 560 B.C. See also FABLE.

**AESTHETICS**, that branch of philosophy which is concerned with the nature of beauty, and with the relation between art and life. One of the great questions in this field has been whether art should be severely censored, and encouraged only in so far as it fosters the ideal things of life. Aristotle says that art should emphasize the good, the proper, the true and consistent, and avoid what is impossible, irrational or morally hurtful. According to him art should represent the perfection of which nature falls short.

Others have felt that art should have nothing to do with the moral improvement of life, but should dwell apart in an ivory tower, so to speak. Kant's aesthetic theory lends itself to this interpretation since he says that to regard an object aesthetically we must contemplate it disinterestedly; that is, without any interest in its existence, as if it were merely a vision. As soon as we care about the existence of an object and make any practical response, negative or positive, our attitude is not aesthetic. Beauty lies solely in the form, the shape, the appearance of a thing. This view has recently been advocated by Clive Bell and Roger Fry who go to the extreme of saying that content and subject matter have nothing to do with beauty. To ask what a picture represents, or what a story is about, is beside the point. In the opinion of these men all that counts is abstract form. Croce belongs to this camp since he says that beauty consists simply in successful expression, which is purely a matter of form, utterly independent of any sensuous enjoyment, logical, practical, or ethical significance. Santayana agrees that the formal aspect of beauty is very important, but thinks that sensuous pleasure is so fundamental as to be the material and stuff of beauty. Form, he says, must be the form of something—of color, sound, or some other sensation or combination of sensations. In addition to its material and form he stresses the

associations that a beautiful thing may have. According to him, our pleasure in the material and form of a thing will be enhanced if we know that it is also true or useful; its beauty will be marred if we associate it with deceit or uselessness.

John Dewey and his followers hold that a thing is beautiful in so far as it shows an adaptation of means and ends. They avoid a sharp difference between fine art and applied or industrial art. A bridge, a ship, an automobile, may be a work of art as truly as a statue or painting. From this point of view any piece of work which is well adapted to some purpose is a work of art. Every need that we have craves satisfaction, and we need to exercise all our capacities. Objects that have no other use may be very useful in exercising the eyes or ears, and through them the whole organism. As Lipps has shown, we "feel ourselves into" objects that we contemplate aesthetically, such as towers, trees, rivers, drawings, musical compositions; and we call them beautiful if we like the way it feels to identify ourselves imaginatively with them. They may give us a more ample balance and a fresh vigor as we sense the incipient movements and patterns of movements that they suggest. A novel, through its characters and situations, may exercise sides of our personality that have no chance to function in everyday life, and may give cues for the better adjustment of our life to the conditions around us. A city may be planned to enhance the well-being of millions. Nations and the world itself may some day be regarded as works of art, if every detail in them can be harmonized with every other in a complete integration of means and ends.

In this theory of art there is no place for the controversy between classic and romantic art, any more than for the distinction between fine and applied art. The only differentiation to be taken seriously is that between good art and bad art; or art in which means and ends are fused, and art in which they are not. Form and content cannot compete for first place because the form is beautiful only in so far as it brings together means and ends, and the content is nothing but the means and ends brought together. If a bridge merely spans a river, the successful spanning of the river is its only beauty. If the bridge is also designed to please the eye and the whole body through the balanced tensions of the eye, then its beauty is more complicated, but it still consists in the adaptation of means to ends. According to our nature, education and mood, we prefer more or less complication. Too much is baffling; too little is boring. But the right proportion is both stirring and soothing.

Whatever our special necessity, we always need excitement and repose; hence both invariably enter into beauty. In fact they constitute beauty. There is no beauty that does not represent the stimulus of a problem and the solace of its solution. Schopenhauer and Nietzsche are doubtless right in holding that beauty must exhibit the striving of the will, and yet give deliverance from it. In this deliverance is the secret of the disinterestedness dear to Kant and the

lovers of abstract form. But here also is the practical activity that is the means of the release. Here are the twin essences of life, effort and peace, reflected in the mirror of art, and thus art still represents the ideal, as it did for Plato.

VAN M. A.

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**AESTIVATION**, or summer sleep, the state of torpidity induced in animals by excessive dry heat, corresponding to hibernation, or winter sleep. Most prominent among aestivating animals of America are the land snails, although frogs, slugs, some fishes and other aquatic and semi-aquatic animals also aestivate. When the dry season comes, land snails secrete several diaphragms across the openings of their shells and remain quiescent until autumn showers fall. Slugs bury themselves in the ground and bivalve mollusks in mud. The Iberian water turtle hides under rocks; frogs burrow into mud and exist for months in its unbaked hardness. The African lung-fish digs into mud almost 2 ft., curls its tail around its body, which becomes covered with mucus, and there exists, drawing air through a long tube and living on the breakdown of body fat and tail. The persistence of the aestivating habit is illustrated by the tenrec, which in temperate zone zoological gardens, where food and water are abundant, aestivates at the time of their scarcity in its native Madagascar.

In botany the word aestivation refers to the arrangement of the parts, especially the petals, of a flower before the opening of the bud. *See also* HIBERNATION.

**AETHELBERT** (c. 552-616), English King, the son of Eormenric, became King of Kent in 560, while still a child. During his reign, he was visited by St. Augustine in 597, and was later converted to Christianity, allowing St. Augustine and his monks to establish themselves at Canterbury. The code of laws written in German, promulgated by Aethelbert, was important in the development of Anglo-Saxon law.

**AETHELRED II (THE UNREADY)** (c. 968-1016), English King and son of King Edgar, was born about 968 and became king at the early age of 11 years. The distinguishing feature of his long reign was his constant struggle with the Danish raids and invasions. These raids gradually became political in their character and when Æthelred died in 1016, King Canute the Great married Emma, his widow, and became king of England.

**AETHELSTAN** (894-940), King of the Saxons and illegitimate son of Edward the Elder, whom he succeeded as ruler in 924. After a successful invasion of Scotland in 934 he overthrew a confederacy composed of Scotch, Welsh and Irish chieftains. Æthelstan was accounted as true overlord of Britain. One of his chief claims to fame was his diplomacy in bringing England into contact with the countries on the continent, establishing friendly relations with the royalty of France, Germany and Norway. He died in 940.

**AETHELWULF** (?-858), King of the West-Saxons, son of Egbert, whom he succeeded as king of Wessex upon his death in 839. Aethelwulf is said to have been a quiet and leisurely king. He offered little resistance to the harassing invasions of the Danes until 842, when he made an effort to repulse them at Charmouth, but was defeated by a fleet of 35 ships. Later with the aid of his son, he routed the Danes at Ockley. He made a trip to Rome where he stayed a year and upon his return married Judith, daughter of CHARLES THE BALD. He died on Jan. 13, 858, and was buried at Winchester.

**AETHER.** *See* ETHER.

**AETIOLOGY**, or **ETIOLOGY**, the study of the causes of disease. Some diseases are due to the failure of the body cells to perform their proper functions. Cellular activity depends on adequate nutrition and satisfactory correlation with the nervous system and to some extent is controlled by internal secretions. When cells become inactive, their metabolism is disturbed; the building-up processes lag and cells waste away.

Plant and animal organisms are responsible for much of the interference with the cellular activities of the body that results in disease. Among these, bacteria and protozoa are particularly important since they are the aetiological agents of many of the most virulent diseases. Only a few of them are pathogenic, however; the majority of species are harmless and some of them are beneficial. Harmful bacteria, such as those responsible for diphtheria and tetanus, elaborate poisons known as toxins. Others when they die and disintegrate liberate toxins known as endotoxins. These toxins injure or kill the surrounding cells and initiate inflammatory reactions.

Protozoa may produce toxic substances which destroy cells or enzymes which dissolve away the adjacent tissue. Thus the organism of amoebic dysentery not only burrows its way mechanically into the intestinal wall of its host but also secretes an enzyme which breaks down the cells, giving rise to ulcers. It is known, for the most part, which species of bacteria and protozoa are responsible for the germ diseases but not very much is known about how they injure the cells of the host.

The aetiological agents of certain diseases of plants, lower animals and man are classed as filterable viruses, that is, they are agents so small that they are able to pass through the minute pores of very fine filters. To this group belong the causative agents of the common cold, smallpox, certain types of tumors, mosaic disease of tobacco and many others. Dietary deficiencies account for another series of diseases including rickets, beriberi, scurvy and pellagra. Injuries to the organs of internal secretion are responsible for such diseases as diabetes mellitus, goiter, Addison's disease and gigantism. The aetiology of certain important diseases is still unknown. This is true, for example, of cancer and a type of arthritis deformans. It is obviously necessary to determine the aetiology of a disease in order to combat it with the greatest hope of success.

R. H.



**AETNA, or ETNA, MOUNT**, an active volcano near the northeastern coast of Sicily, in the eastern part of Catania. The highest volcano in Europe, it rises to an estimated height of 10,758 ft. It is an almost circular cone flattened at the top and is about 90 mi. in circumference at the base. Various eruptions have given rise to a multitude of cones that protrude from the sides. Covering an area of 469 sq. mi., the mountain is almost completely encompassed by the Alcántara and Simento rivers, with the sea forming the eastern boundary. The Valle del Bove, an immense ring-shaped chasm, 3 mi. long and surrounded by cliffs over 3,000 ft. high, at one time the principal crater, is the result of the deterioration of the volcano on the east side. The vegetation—and consequently the population—depends on the altitude. In the lowest reaches there are well-cultivated farms where corn and vegetables are raised in abundance, and olive orchards and vineyards flourish. Here the population is dense. Next comes a scantily populated forest region of birch, beech, chestnut and pine. Above 7,000 ft. barrenness prevails. From this snow-crowned summit one looks out on lava beds, masses of ashes, and rocky precipices. About 80 eruptions have been recorded, the earliest occurring in 476 B.C. and the latest in 1928.

**AETOLIA**, a district of northern Greece, north of the Corinthian Gulf and south of Acarnania. The river Achelous runs on its western border. This river with the Euenus form one division of the district. The valley here is fertile, while the northeastern part is mountainous and the passes are few. Some of the peaks rise to over 7,000 ft.; Kione is over 8,000. The Aetolians were a primitive people up to the 4th century B.C., but at the rise of power in Macedonia, the Aetolians formed a national league for protection against their enemies. This league was one of the first in Greece and became more and more powerful until it controlled almost all of central Greece. It met once a year at Thernum. The federal constitution was efficiently drawn up and carried out, but the acts of violence of the leaders led to their downfall. In the 15th century Aetolia fell to the Turks, but is under Greek control to-day.

**AETOLIAN LEAGUE**, one of the rival leagues of Greece opposed to Macedonian supremacy. After the Battle of Chaeronea in 338 B.C., the Greek cities realized that they must unite in order to save themselves. Two rival leagues thus came into being, one on each side of the Corinthian Gulf. On the south side was the **ACHAEAN LEAGUE**, and on the north the Aetolian League. Instead of presenting a united front to the Macedonian threat the leagues fought each other. They were further weakened in their efforts by the fact that neither Athens nor Sparta would join them. The Aetolian League outlived its rival but was unable to gain for Greece either commercially or politically what she had lost by the rise of Macedon. Commerce was more and more shifted to the East, and the Greek cities sank into secondary positions. Although retaining its independence politically, each

city of the league pooled its military strength and its commercial resources for a common cause. But the effort to unite came too late.

**AFFECTION**, a psychological term designating the feeling aspect of consciousness. The affective side of mental life occupied one of the main divisions of the textbooks in psychology when that subject was primarily interested in consciousness. The customary tripartite treatment gave feeling coordinate rank with cognition and will. The problem from the standpoint of affection was that of finding the elements of feeling. Pleasure and pain were the two main elements. All the affective life could thus be reduced to states of pleasurable and painful feelings. These combined into higher states of feeling and finally formed the more complex emotions. Pain is now regarded as a sensation, whereas pleasure still gives the psychologist much more trouble. The tendency is to consider feeling as a part of the affective-motor side of life, thus uniting feeling and will much more intimately than was the case when affection was given a separate status, or rather was regarded as one of the three main aspects of consciousness.

**AFFIDAVIT**, a written statement sworn to before some person who has the authority to administer oaths. Any one of age can make an affidavit, excepting insane people, and in certain states convicts. If an affidavit is made by one person for another, the reason and necessity must be stated; the facts usually should be within the personal knowledge of the affiant and not dependent upon hearsay. In general, courts of records have power to take affidavits for use before them. **STATUTES** designate persons as, **NOTARIES PUBLIC**, and **Commissioners of Deeds**.

**AFFINITY, CHEMICAL**. See **THERMODYNAMICS, CHEMICAL**.

**AFGHAN**, an Iranian language of the **INDO-IRANIAN** linguistic group of **INDO-EUROPEAN** spoken in southern Afghanistan (south of Kabul), in the autonomous northwestern zone of India (Waziristan, etc.), and in the direction of the Indus toward Peshawar. It falls into two dialects called Pakhto (northern) and Pashto (southern) because of their characteristic correspondence of *k*h and *sh*. Typical of Afghan are the correspondence of *l* to Persian *d* (*las* "hand" = Persian *dast*) and an infinitive in *-al*, e.g., *pushtedal*, "to question." Afghan is a harsh, virile language with many guttural and sibilant spirants. Indian-borrowed words are frequent, and Indian cacuminal sounds have also found their way into it. Afghan distinguishes between the masculine and the feminine gender, and its noun has two cases in the singular and two in the plural. In the past tense the verb affects a passive construction ("the horse was seen by him" = "he saw the horse"), and has a complicated system of prefixes to express tenses and moods.

V. M.

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**AFGHÁNISTÁN**, a mountainous wholly inland country in the middle of Asia. Numerous boundary commissions have traced its frontiers which, however, are not yet wholly settled. To the north, Afghánistán is the neighbor of Russia, and here the border includes the river Oxus. On the west, there is Persia and to the south, Baluchistan, which is under British influence. On the east Afghánistán is in contact with the Northwest Frontier of India. To the statesman the country is strategically important as a buffer state between the British and Russian sovereignties. For this reason Afghánistán is wholly without railways. On the north the Russian rail-heads are situated close to the frontier at Termez and Kushka. The British on their side have carried a line from Peshawar up the Khyber Pass to Landi Kotal; to the south the railway has been extended from Quetta through northern Baluchistan to Duzdap on the Persian frontier. Within Afghánistán, traffic depends chiefly on camels and ponies, but here as elsewhere in the undeveloped east the automobile is bringing with it a new era, and gradually some roads are being improved.

The area of Afghánistán is estimated at about 245,000 sq. mi., as compared with 266,000 sq. mi. for Texas. The extreme length of the country from northeast to southwest is 700 mi. and the population was estimated in 1931 at 11,000,000. The capital is KÁBUL, pop. about 100,000. Other towns are Kándahar, pop. with suburbs est., 60,000; Herat, est. pop., 121,000; and Jalalabad, pop. est., 6,000. Dominated in the east by the Hindu Kush Mountains, which rise to 25,425 ft., much of Afghánistán is a wild and rocky country with ice on the upper peaks and ridges. Many varieties of trees and flowers clothe the mountains at various altitudes, and the valleys, often irrigated, are very productive. There are two harvests, a spring crop of wheat, barley and peas and beans, and an autumn crop of rice, millet and Indian corn, tobacco, beet and turnips. Afghánistán is famous for its fruit and nut trees, including apple, quince, peach, pear, plum, orange, almond, walnut and pomegranate. The mulberry is extensively cultivated, as well as the asafoetida, madder and castor-oil plants. The people breed camels, horses, humped cows and goats, dogs and also the indigenous fat-tailed sheep, the wool and skin of which are the principal export. There are evidences of mineral wealth as yet hardly developed. Gold is found in the streams, and silver mines are located on the Hindu Kush. Copper, lead, iron and coal of uncertain quality have been discovered, also precious stones, including excellent lapis lazuli from Badakhshan. But the trade of Afghánistán is still very small, and there are no exact statistics showing its volume. An estimate is \$15,000,000 on the Indian frontier and \$9,000,000 on the Persian and Russian borders. The public revenue is \$10,000,000.

#### HISTORY

Many of the people are mountaineers, jealous of their independence, accustomed to feuds, expert with the rifle, conservative in domestic susceptibilities and

fanatical adherents of Islam, belonging chiefly to the Sunni sect. The Afgháns are described as Pathans, but according to the chronicles of the country, which is far from devoid of literature, the nation is called Ben-I-Israel and is descended from King Saul who, according to this tradition, had a son, Jeremiah, and a grandson, Afghana. A variation of the legend is that King Solomon sent settlers to the Sulaiman mountains; it is also said that King Nebuchadnezzar settled around Herat a part of the ten tribes taken captive in Palestine.

When history dawned, Afghánistán belonged to Persia, the territory being divided between the province of Aria and Bactria. In his famous march to the Indus, Alexander the Great traversed Afghánistán, which was included in his Macedonian Empire. The conqueror was succeeded by Seleucus Nicator, but in the 3rd century B.C. the Seleucids were superseded by the Parthians, and in the 2nd century a Scythian tribe gave its name to the province called Seistan. Early in the Christian era Afghánistán was conquered by the Buddhist Kushan tribe from central Asia, which extended its authority as far as Benares. Its sway did not end until the 9th century. Under the pressure of invading Islam, an Arab dynasty called the Tahirids, virtually independent of the caliph at Bagdad, incorporated Herat and Balkh in the kingdom of Khurasan to the north. In 998 A.D. Mahmud, the son of a slave, ascended the throne, establishing a great empire with Ghazni as capital. This dynasty was dispossessed in 1153 by Alaaddin Husain, chief of Ghor, who, in revenge for the death of his brother, destroyed Ghazni and became known as "the world-burner."

After prolonged confusion extending into the 13th century, Afghánistán like Persia was ravaged by GENGHIS KHAN and the comparatively uncivilized Mongols. The 14th century saw the rise of another Mongol, TAMERLANE. In the 16th century Afghánistán suffered a partition between Persia, India and Transoxiana to the north. In 1737 Nadir Shah of Persia invaded India through Afghánistán, having in his army a young chief called Ahmed Khan, who, when Nadir Shah was assassinated, was chosen king by the Afghans. His title was Durr-i-dauran, "the pearl of the age," whence his tribal name, Durani. Ahmed created the modern kingdom of Afghánistán and extended it eastward over the Punjab and Kashmir and westward over Turkestan. While Shah Shuja was dealing with rebellion in Kashmir, his brother and rival, Mahmud, ousted him from the throne and ruled until 1818. Later Dost Mohammed, brother of Fath Khan, emerged to rule the country from 1826 to 1835. Fearing Russian influence and desiring the surrender of all claims to the Punjab and Kashmir, a British army of 21,000 traversed Bolan Pass and occupied Kandahar. Shah Sujah was restored to the throne and Dost Mohammed fled. In Nov. 1841, however, rebellion broke out, Burnes and his staff being massacred. Akbar Khan, the son of Dost Mohammed, while actually conferring



with the British, stabbed Sir William MacNaghten. The garrison had been reduced to a small force of British and Indian soldiers, and there were 12,000 non-combatants including many women and children. Under promise of safe conduct they agreed to evacuate the country; but in the terrible defile called Khoord Kabul, a part of the Khyber route, the entire expedition was wiped out save for a few captives. In Jan. 1842 one survivor, Dr. Brydon, rode alone into Jalalabad and told of the disaster. Moreover, Shah Sujah was assassinated. In April, Gen. Pollock proceeded to Kabul where he destroyed the citadel and the bazaar, and recovered the prisoners. Dost Mohammed then ascended the throne. In the middle of the 19th century, he lost the battle of Gujarat against the Sikhs, after which Peshawar was annexed by Great Britain. During the mutiny, the Ameer did not interfere, and in 1863 he captured Herat. In this same year he was succeeded by his son, Sher-Ali Kahn. He died in 1879 and his second son, Yakub Khan, ascended the throne. By treaty Yakub Khan ceded the control of the Khyber and Kurram passes, with other regions of the North West Frontier, to Great Britain. On a British residency being attacked and its occupants murdered, Lieut.-Gen., later Earl Roberts, advanced to Kabul, and Yakub Khan abdicated. Five years later Abdur Rahman Khan, nephew of Sher-Ali, ascended the throne. He made good his position, reigning until 1901 and vigorously organizing the country. Habibullah succeeded him, and introduced automobiles, telephones and other evidences of western progress into the country. By the Anglo-Russian Agreement of 1907, Britain and Russia pledged themselves against interference.

At the opening of the World War, the Ameer declared his neutrality. On Feb. 20, 1919, Habibullah was assassinated. His brother, Nasrullah Khan, reigned for a week as ameer but was superseded by his nephew, Amanullah, as king. In May 1919 Amanullah declared war on India. Shortly after, he thought better of it, however, and peace was signed at Rawal Pindi in the Punjab on Aug. 8, 1919. The Ameer was released from Anglo-Indian control of foreign countries and by a further treaty dated Nov. 1921, legations were established at London and Kabul. Now there are other legations at Moscow, Berlin, Teheran, Paris, Rome and Angora. Afghanistan is allowed to import munitions of war through India free of duty, but she does not yet belong to the League of Nations. Her independence has been somewhat restricted. In 1921 Russia replaced the British subsidy by a grant of 1,000,000 rubles or \$500,000, but Great Britain successfully objected to treaty provisions by which Russian consulates would be established at Ghazni, Jalalabad and Kandahar. An attempt by Amanullah to modernize the country in Jan. 1929 was greatly resented. His misfortunes, and succession by Nadir Khan on Oct. 15, are related under AMANULLAH KHAN.

**A FORTIORI**, a form of argument that affirms a conclusion for even better reasons than those already

given. The *a fortiori* argues from the fact that, if certain conditions are true under admitted circumstances, much more should they be expected to be true under the conditions pointed out. An illustration may be given. When a man has been able to control his physical environment to the extent of ridding himself of famine and pestilence, of making nature do his bidding by providing him with all kinds of physical comforts, much more ought he be able to learn to control his social environment and rid himself of the institution of war if he but as seriously set himself to the task. The *a fortiori* is usually an effective form of argument.

**AFRICA**, the southernmost continent of the eastern hemisphere, separated from Europe to the north by the Mediterranean Sea, and connected with Asia to the northeast by the Isthmus of Suez. On the west and southwest it is bounded by the Atlantic Ocean, on the east by the Red Sea and Indian Ocean and on the southeast by the Indian Ocean. Between its extreme north and south points, which are Cape Blanco in Tunis at 37° 9' N. lat. and Cape Agulhas at 34° 49' S. lat., the continent measures about 5,000 mi. The greatest distance from west to east, which is between Cape Verde at 17° 25' W. long. and Cape Guardafui at 51° 25' E. long., is 4,600 mi. Within these limits the continent has an area of about 11,262,000 sq. mi., making it second in size only to Asia. About midway its length is divided by the Equator into north and south Africa, the former being much the larger section because of the increase in width to the west. The 20th meridian E. divides it into east and west Africa. Practically the whole continent lies within the torrid zone with only a small portion at either end extending into the temperate zone.

**Surface Features.** Considered broadly, the surface of Africa is a great plateau which descends to a narrow coastal plain over a sea-facing escarpment of varying height and steepness. While its mean altitude is 2,000 ft. above sea level, there is a difference of 20,110 ft. between its highest and lowest points which are Mt. KILIMANJARO or Kibo, 19,710 ft., in Tanganyika Territory and a depression in the Libyan Desert at 400 ft. below sea level. The broad expanse of desert country in north Africa has an average elevation of about 1,300 ft. while the section south of the Equator has a mean altitude of between 3,000 and 3,500 ft.

There is no long, continuous system of mountains in Africa but ranges of irregular size and height are in many places superimposed upon the rim of the plateau. Along the northwestern coast, running from Cape Nun in Morocco northeast to Cape Bon in Tunis which is about 1,400 mi., are the parallel ridges of the ATLAS MOUNTAINS. The Maritime Atlas chain overlooks the Mediterranean, and the Saharan Atlas chain lies inland on the border of the desert. In Morocco Jebel (Mt.) Ayashin rises to 14,000 ft. Along the eastern coast a low ridge skirts the shore of the Red Sea and continues southward as a series of ranges

of volcanic origin. They begin with the mountain knot of Abyssinia which contains some snowcapped peaks such as Ras Dashan, 15,150 ft., and run southward through the lake region of east Africa where they form two longitudinal depressions known as the Rift valleys. The western or Albertine Rift is occupied by Kivu, Edward and Albert Lakes, and by Lake Tanganyika, 400 mi. long, the longest lake in the world. The Eastern Rift contains Lake Victoria with an area of 27,000 sq. mi., the largest lake in Africa, and Lake Rudolf. The two valleys converge at Lake Nyasa which is noted for its depth of 2,580 ft. Of special interest are the Ruwenzori Mountains between lakes Edward and Albert, consisting of a snowclad range lying across the equator, which culminates in Mt. Margherita, 16,815 ft. high. The Mfumbiro Mountains northeast of Lake Kivu cover a volcanic district and have three active volcanoes. Ninagongo has three craters, one over a mile in diameter. Mt. Kilimanjaro or Kibo, forming the highest point of the otherwise low Usambara range in northern Tanganyika Territory, is an extinct volcano covered with glaciers and snow. Mt. Kenya, 17,000 ft., which is snowcapped and covered with a magnificent forest of cedars, is also a volcanic peak.

The plateau in south Africa is rimmed by the volcanic Lebombo chain in Mozambique, and by the Drakensberg Mountains which run from the northwest corner of Natal through Basutoland and spread in the Cape of Good Hope Province to a series of ranges having various names. This arrangement creates a system of terraces from the plateau to the coastal plain. The terrace between the main system and the subsidiary range to the south is a wide expanse of pasture land known as the Great Karroo. Along the western edge the mountains continue as the highlands of southwest Africa.

In the interior of south Africa are the high tablelands of Rhodesia which are rich in gold and other minerals, the Bechuanaland plains and the Kalahari Desert. The latter covers about 275,000 sq. mi. and has an average altitude of 3,000 ft. Largely bush country with its deep sandy soil thrown up in the southwest into brilliant red dunes, it is devoid of running water except in the north.

North and west Africa, measuring from the valley of the Nile to Cape Verde and from the Saharan Atlas to the headwaters of the Congo, comprises over half the continent. It includes the Sahara with the Libyan and Nubia deserts, the Sudan, the coastal regions of upper and lower Guinea and much of the basin of the Congo. The region bordering the Gulf of Guinea has a marshy coast cut by lagoons and overgrown with mangrove forests. Farther inland is a belt of dense equatorial forest which gives way northward to higher and more open regions covered with low bush and gradually merges into the open savannas of the Sudan. In French Guinea there is a mountain district called the Futa Jallon which contains the headwaters of the Gambia, Senegal and Niger rivers. Nigeria contains the Came-

roon Mountains which culminate in Cameroon peak, 13,746 ft. high.

The SAHARA is the largest continuous arid region in the world, covering with the Libyan and Nubian deserts approximately 3,000,000 sq. mi. It is crossed from northwest to southeast by a broken range of mountains on either side of which are rolling sandy wastes swept by simoons which pile up ranges of dunes. The shifting sands make permanent roads impossible so that travel is chiefly by caravan. The general barren aspect of the desert is relieved occasionally by oases such as Tafilet in southern Morocco; Ghadames, Ghat and Murzuk in Libya; and Tuggurt, Laghouat, El Golea, Ouargha and several near Biskra in southern Algeria. Of all oases the largest and most important is the lower valley of the Nile which is noted for its productivity.

The NILE is the longest single river in the world, having a course of 4,000 mi. before emptying into the Mediterranean through a two-mouthed delta. It is continuously navigable for 590 mi. from the delta to Assuan and, with interruptions, 1,550 mi. farther. Practically all large rivers in Africa have a long course in the interior of the country and descend over the plateau escarpment by a series of cataracts which prevent continuous navigation. Owing to this condition, exploration of the interior of the continent has been retarded and difficult. The Congo, 3,000 mi. long, ranking next to the Amazon in point of volume and size of basin, drains a vast portion of equatorial Africa into the Atlantic through a mouth 10 mi. wide. It admits of navigation with some interruptions for 2,000 mi. The Niger, 2,900 mi. long, in French West Africa, is the most easily navigable. It discharges through an immense delta on the Gulf of Guinea. The great ZAMBEZI, 2,000 mi. long, in south Africa, is interrupted near the middle of its course by VICTORIA FALLS, a voluminous cataract 1 mi. wide with a drop of 343 ft. Of the four great rivers, the Nile flows partly and the Congo and Zambezi entirely within south Africa, leaving only the Niger entirely to the north. Chief among the tributaries of the Nile are the ATBARA and BAHR-EL-GHAZAL rivers. In the south there are also the LIMPOPO and ORANGE rivers, and in the west the 1,000 mi. long SENEGAL and the GAMBIA which runs a twisting course of 1,000 mi., and is penetrable by ocean-going boats for 200 mi. from its mouth.

Aside from the great lakes situated in the Rift valleys, there is in the central Sudan the broad, shallow LAKE CHAD, or Tchad, which has no outlet. During the rainy season it has an area of about 40,000 sq. mi. but evaporates to one-sixth of this size in the dry period. Lake Chad is fed by the Shari River which enters its southern side after draining a large area in French Equatorial Africa and the Cameroons. LAKE DEMBEA or Tzana in Abyssinia has 1,160 sq. mi. of surface and discharges its waters into the Blue Nile. The headstreams of the Congo in Central Africa form LAKE BANGWELO and in south Africa is LAKE NGAMI of a constantly varying size.

The coast line of Africa is remarkably regular, for which reason there are few good harbors. Its total length is about 19,000 mi., less than one-half that of Europe. Only a few islands border the shore. The largest, MADAGASCAR, lies off the eastern coast as do Zanzibar, Pemba and Mafia; and the Madeira, Canary and Cape Verde islands lie near the western margin. Farther away in the Atlantic are ASCENSION ISLAND and St. Helena where Napoleon was exiled, in the Indian Ocean the Seychelles and northeast of Italian Somaliland in the Arabian Sea the island of Socotra.

For discussion of the geology and for additional details regarding the physiography of the continent, see E. Krenkel, *Geologie Africas*, 1926; A. L. Du Toit, *The Geology of South Africa*, 1926; J. W. Gregory, *Geology and Rift Valleys of East Africa*, 1921; W. F. Hume, *Geology of Egypt*, 1925; J. D. Falconer, *Geology of Northern Nigeria*, 1911; L. de Launay, *Les Richesses minerales de L'Afrique*, 1903; E. Suess, *The Face of the Earth*, 1904-24.

**Climate.** Since Africa extends for an almost equal distance north and south of the Equator, it has less variation in temperature than any other large land division. The equatorial belt, taking in the basin of the Congo and the coast of the Gulf of Guinea, is consistently hot with abundant rainfall and is characterized by dense forests. On the plateau, Nairobi at  $1^{\circ} 17' \text{ S. lat.}$  has a mean temperature of  $65.8^{\circ} \text{ F.}$  in March, its warmest month, and in July, its coolest month, of  $59.4^{\circ} \text{ F.}$ ; annual rainfall, 38.9 in. Duala on the coast at  $4^{\circ} 3' \text{ N. lat.}$  has a mean temperature of  $77.9^{\circ} \text{ F.}$  for the year and an average rainfall of 159 in.

On either side of the equatorial belt are grassland districts, the Sudan to the north and bush veld to the south, where there are alternate wet and dry seasons and the climate is tropical. Outside of these districts are the Sahara and Kalahari desert regions in the path of the drying trade winds. Timbuktu, between the Sudan and Sahara at  $16^{\circ} 43' \text{ N. lat.}$ , has a mean temperature in January of  $70.2^{\circ} \text{ F.}$  and in June of  $94.3^{\circ} \text{ F.}$  Its annual rainfall is 6.8 in. Cairo at  $29^{\circ} 52' \text{ N. lat.}$  has a mean January temperature of  $55.2^{\circ} \text{ F.}$ , a mean July temperature of  $82.2^{\circ} \text{ F.}$ , and an average of 1.3 in. of rainfall yearly.

The northern and southern extremities in the temperate zones have a subtropical or Mediterranean climate, that is, a hot dry summer with a cool rainy winter. Algiers, at  $36^{\circ} 37' \text{ N. lat.}$ , has a mean temperature in January of  $54^{\circ} \text{ F.}$ , in August of  $78.2^{\circ} \text{ F.}$ , and 26.8 in. of rainfall yearly. Cape Town at  $33^{\circ} 56' \text{ S. lat.}$  has a mean temperature in July of  $54.7^{\circ} \text{ F.}$ , in February of  $70.3^{\circ} \text{ F.}$ , and 25.3 in. of rain yearly.

Wadi Halfa in Egypt at  $21^{\circ} 55' \text{ N. lat.}$ , has the hottest summers on earth. There the daytime temperature exceeds  $113^{\circ} \text{ F.}$  every month in the year but December, although at night the temperature sometimes drops below freezing. The highest reading ever taken under standard conditions was  $136.4^{\circ} \text{ F.}$  at Azizia, 25 mi. south of Tripoli.

**Flora.** The vegetation of Africa is comprised in three major regions, the north temperate, the tropical

and the south temperate. The flora of northwestern Africa strongly resembles that of southern Europe. The wooded growths consist largely of evergreen oaks, cork trees and pines, intermingled with cedar, cypress and myrtle. In the arable areas the common cereals are grown. To the south of this fertile area and also to the east along the Mediterranean there is a steppelike region characterized by clumps of esparto and other grasses. This somewhat sterile steppe merges southward into the exceedingly arid Sahara, the world's greatest desert, with immense areas containing little or no vegetation. The stunted thorny plants that occur are especially adapted to withstand extreme aridity. In the oases the date palm and alfalfa flourish. Along the southern border of the Sahara the vegetation again becomes steppelike, forming a belt extending entirely across the continent. This steppe is characterized by thorny acacias and doum palms.

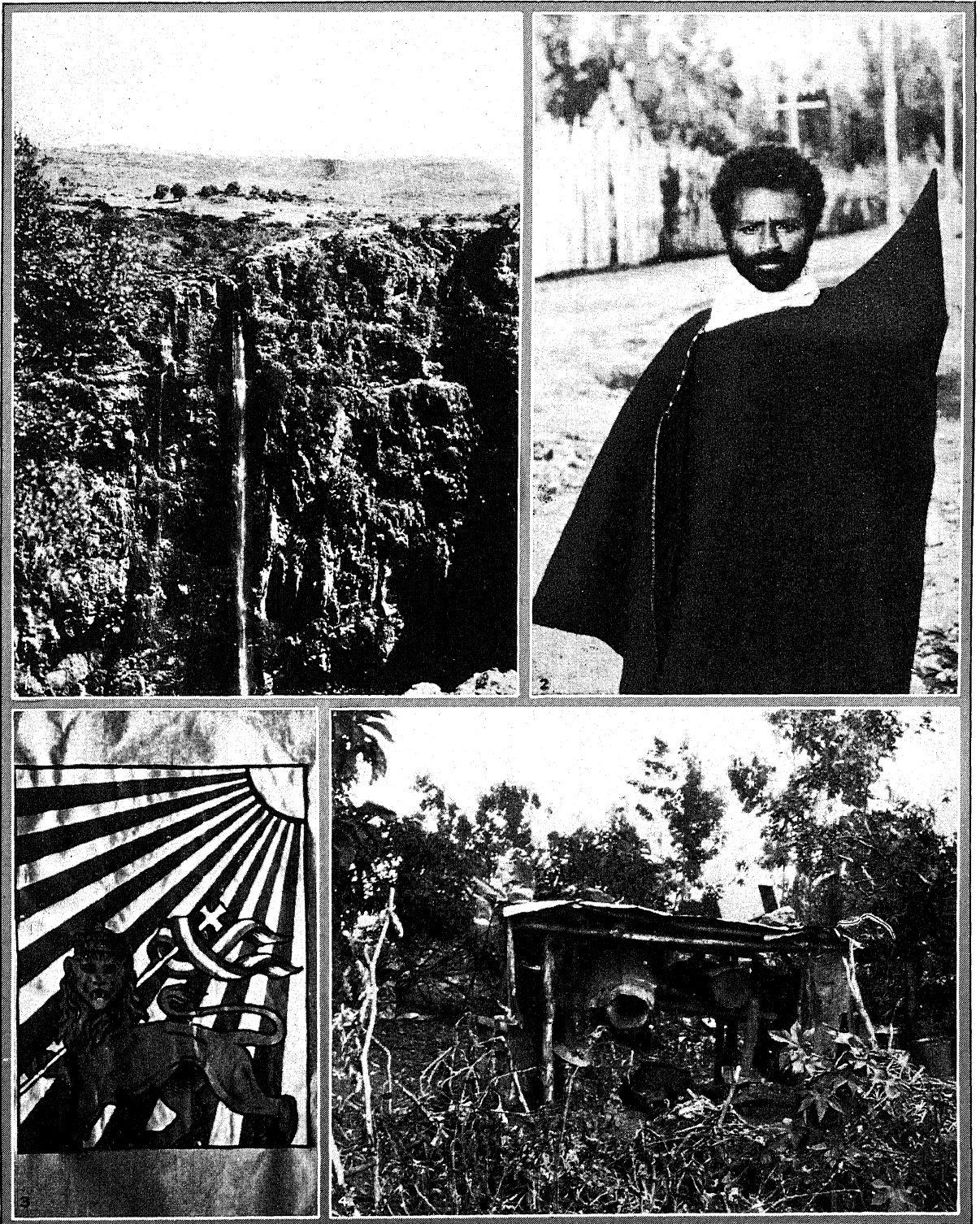
In the moister regions of central Africa, south of the steppes, the vegetation consists of savanna and equatorial forest. By reason of abundant rainfall and equable temperature dense forests have been developed covering most of the tropical coast of western Africa and a large part of the Congo basin. In these forests an immense variety of trees occurs, including the oil palm, the bamboo palm, the silk-cotton tree and valuable timber trees. Except the western equatorial forest, the whole of tropical Africa is a savanna covered with vegetation of strikingly uniform character. This savanna region extends in a broad zone from Senegal to Abyssinia, thence southward in eastern Africa around the borders of the equatorial forest and westward again to the Atlantic near the mouth of the Congo. Noteworthy plants of the savanna region are the massive baobab or monkey-bread tree and giant candelabra-like euphorbias.

The south temperate region, though lacking in forests, possesses a very distinct flora, noted for the brilliancy of its flowering plants and especially for the variety and abundance of its heaths.

**Fauna.** The Tropic of Cancer, which crosses the Sahara nearly at its center, approximately divides the continent into two well-defined zoological regions. The area at the north, regarded as part of the Palearctic region, has animals closely similar to those of Europe and adjacent Asia. The area to the south, called the Ethiopian region, possesses a distinctive fauna containing numerous animals not found elsewhere in the world. Among these are many large ungulate mammals, notably the giraffe, okapi, zebra, Cape buffalo, hippopotamus, warthog and waterhog, together with more than 100 species of antelope, including the eland, gnu, springbok and hartebeest. However, no true deer or oxen are found. Other mammals of huge size are the African elephant and four species of rhinoceros.

The carnivores include the lion, leopard, cheetah, jackal and several hyenas and civets, but bears, wolves and foxes are wanting. In Sudan and

## AFRICA



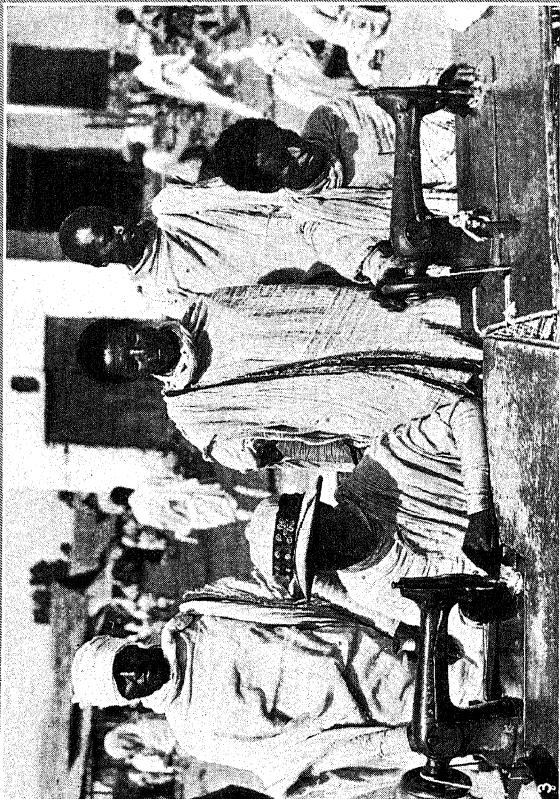
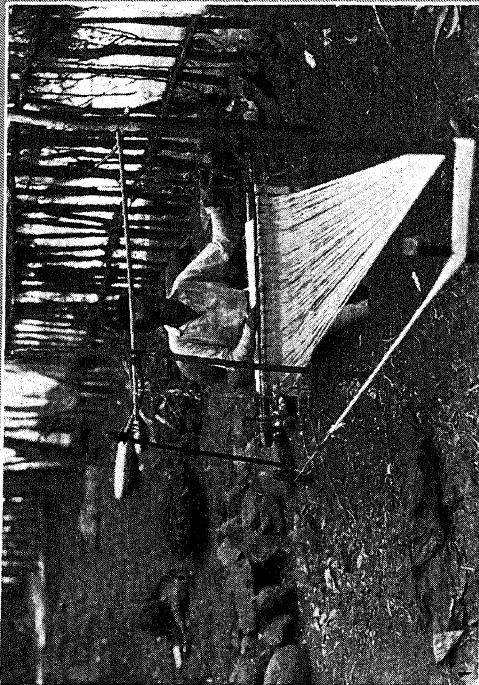
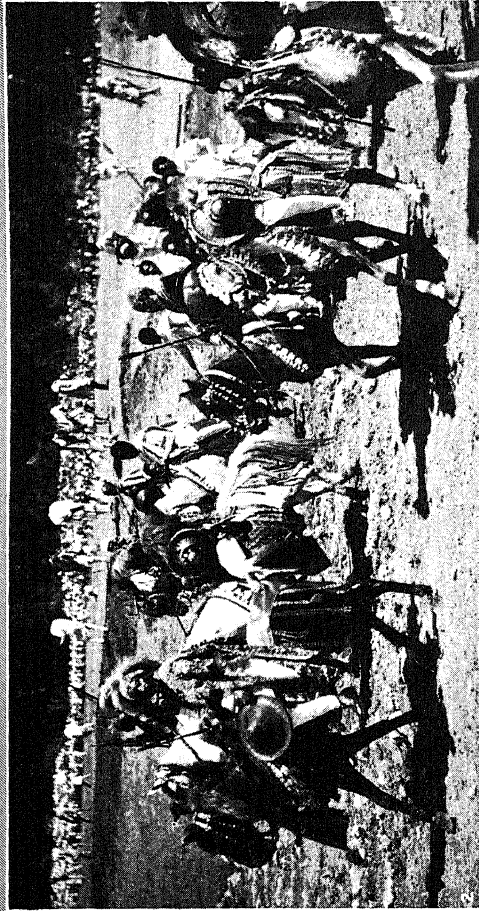
PHOTOS BY NOMLAS

### ABYSSINIA—LAND OF THE ETHIOPIANS

1. Waterfall of 1,500 ft. in Abyssinia. 2. A native wearing a typical heavy woolen cape which accommodates a shouldered rifle. 3. The Imperial Lion of Abyssinia. 4. Beehives; honey is used for *tej*, the national drink.



# AFRICA



## TRIBAL LIFE IN ABYSSINIA

1. A weaver making cotton cloth in an Abyssinian village.
2. Abyssinian cavalry\* at the coronation of the Emperor, Nov. 1930.
3. A "sewing circle" at Addis Ababa. Repairs are made "while you wait."
4. Women with a mortar used to crush geucho, for *tej*, the national drink.

PHOTOS BY NOHLAS

Somaliland wild asses are found. The tropical forests, though inhabited by the chimpanzee, gorilla and elephant, are on the whole devoid of large mammals. Monkeys, notably baboons found only in Africa, are widely distributed. The northern deserts, though poor in wild animals, are the home of the domesticated one-humped camel.

Africa is the land of the ostrich, still widely found. Other large birds are the marabou and secretary bird. The migratory birds are largely identical with those of Europe and adjacent Asia but the resident birds display resemblances to those of Australia and South America. Though lacking the extreme brilliancy and variety characteristic of the tropical American avifauna, many birds of gaudy plumage are found in equatorial Africa. Among these are the bee-eaters, plantain-eaters and especially the honey-suckers which rival the hummingbirds in gorgeous coloration. Other large groups are the honey-guides, flycatchers, warblers, finches and weaver-birds. A few true parrots occur, but macaws and cockatoos are wanting. Grouse-like birds, especially the francolins, are abundant, as are also the guinea-fowls, found only in Africa.

Reptiles are numerous, including crocodiles, monitors, agamas, chameleons, various constrictors, as the rock snake and python, and many venomous serpents, as the deadly puff-adder. Among the freshwater fishes catfishes, carplike fishes and mormyrs form the most numerous groups.

**Population.** The population of Africa as a whole is estimated at 150,000,000. North Africa is occupied chiefly by three distinct and usually antagonistic racial elements, the pure and mixed Negro populations of the Sudan, divided into hundreds of tribes speaking as many different languages; the Hamitic BERBERS and Egyptians, mostly fanatical Mohammedans; and the Semitic Arabs and Abyssinians, the former Mohammedans and once active slave traders, the latter a semi-civilized race professing a corrupt form of Christianity.

In south Africa, excluding the small HOTTENTOT and BUSHMAN groups of the extreme southwest, the whole is inhabited by Bantu negroid people including KAFIRS, ZULUS and BECHUANAS, which so far as language is concerned are homogeneous.

**Political Divisions.** Throughout the extent of continental Africa there are only three independent states. They cover 776,000 sq. mi. and have a population of 26,213,364. Abyssinia has an area of 350,000 sq. mi. and about 10,000,000 people; Egypt, 383,000 sq. mi., 14,217,800 people in 1927; and Liberia 43,000 sq. mi., and about 2,000,000 people. Of the remaining 10,724,000 sq. mi., approximately 4,378,572 are under French jurisdiction, 3,840,791 under British, 938,500 under Belgian, 787,771 under Portuguese, 641,754 under Italian and 127,901 under Spanish rule. The divisions (*see* separate articles on these subjects) with their estimated areas and populations are as follows:

France: The Atlas regions, sometimes called the

Barbary states for its Berber populations, including Morocco, 200,000 sq. mi., pop. 1926, 4,229,146; Algeria, 847,552 sq. mi., 6,063,496; and Tunis, 48,300 sq. mi., 2,159,708. Senegal, 74,112 sq. mi., 1,318,287; the French Sudan, 360,331 sq. mi., pop. 1927, 2,632,618; the Upper Volta, 142,820 sq. mi., pop. 1929, 3,039,543; French Guinea, 89,436 sq. mi., pop. 1929, 2,220,467; the Ivory Coast, 121,590 sq. mi., 1,724,545; Dahomey, 41,302 sq. mi., pop. 1929, 1,080,447; Mauritania, 347,400 sq. mi., 289,184; Colony of the Niger, 463,200 sq. mi., est. pop. 1929, 1,473,601; French Equatorial Africa, 912,049 sq. mi., pop. 1926, 3,127,707; the Sahara desert region not included in other dependencies, over 1,100,000 sq. mi., 450,000; French Somaliland, 5,790 sq. mi., est. pop. 1928, 85,778; island of Madagascar, 228,000 sq. mi., 3,743,642. Except where a later date is given, the population figures are for 1926.

Cameroon and Togoland (formerly German) are held jointly by France and the British Empire. Of Cameroon France has jurisdiction over 166,489 sq. mi. with 1,900,000 inhabitants in 1928, and the British Empire over 34,236 sq. mi. with 700,050 people. Of Togoland France controls 21,893 sq. mi. and the British Empire 12,600 sq. mi. The total population is estimated at 730,027 natives and 477 Europeans.

British Empire: Kenya, 224,960 sq. mi., est. pop. 1929, 3,003,158; Uganda, 94,204 sq. mi., est. pop. 1929, 3,410,857; Nyasaland, 37,890 sq. mi., pop. 1929, 1,360,000; Somaliland, 68,000 sq. mi., est. pop., 344,700, exclusive of natives; Basutoland, 11,716 sq. mi., pop. 1921, 497,540; Bechuanaland, 275,000 sq. mi., pop. 1921, 152,983; Southern Rhodesia, 149,000 sq. mi., est. pop. 1930, 1,092,400; Northern Rhodesia, 287,950 sq. mi., European pop. 1929, 9,981—est. native pop. 1927, 1,298,651; Swaziland, 6,704 sq. mi., pop. 1921, 112,838; Union of South Africa, 471,917 sq. mi., est. pop. 1930, 8,003,697; Nigeria, 335,700 sq. mi. 18,966,574; Gambia, 4,134 sq. mi., est. pop. 1921, 200,000; the Gold Coast, 78,650 sq. mi., pop. 1921, 2,078,000; Sierra Leone, 31,000 sq. mi., pop. 1921, 1,541,311; Anglo-Egyptian Sudan, 1,008,100 sq. mi., est. pop. 1929, 5,519,776; Tanganyika Territory (formerly German East Africa), 374,000 sq. mi., est. pop. 1929, 4,800,630; South-West Africa (formerly German), 332,400 sq. mi., European pop. 1926, 24,115—est. native pop., 237,700.

Belgium: Belgian Congo, 918,000 sq. mi., 8,700,000; the mandate of Ruanda and Urundi (formerly German), 20,550 sq. mi., 3,000,000.

Portugal: Guinea, 22,000 sq. mi., pop. 1928, 343,961; Angola, 486,071 sq. mi., pop. 1926, 2,481,956; Mozambique, 287,756 sq. mi., pop. 1930, 3,514,602.

Italy: Eritrea, 45,754 sq. mi., est. pop. 402,793; Somaliland, 190,000 sq. mi., 1,200,000; Tripolitania, 360,000 sq. mi., est. pop. 1928, 600,000; Cyrenaica, 75,340 sq. mi., pop. 1929, 149,000.

Spain: Rio de Oro and Adrar, 109,200 sq. mi., 495; Ifni, 965 sq. mi., 20,000; Spanish Guinea, 10,036 sq. mi., 140,000; Morocco, 18,300 sq. mi., est. pop. 1926, somewhat under 1,000,000.

Tangier, the international port, has an area of 225 sq. mi. and about 60,000 inhabitants in 1926.

#### EXPLORATIONS AND DISCOVERIES

**Explorers of Pre-Christian Eras.** The first excursions by Mediterranean and other peoples to this second largest of the six continents are unknown to recorded history. All that may be asserted with certainty is that parties of Phœnicians, Syrians and Arabs made occasional sorties inland as early as the 6th century B.C., a fact ascertainable in the accounts of Herodotus (484-425 B.C.), who himself lived a number of years in Egypt. More often than not, these sorties were piratical raids upon tribal settlements, to seize slaves and gold. Since these visits to Africa by Asiatics and Europeans were not motivated by scientific interest, the early narratives of Libya, as Africa was called, are untrustworthy.

The Phœnician voyage to Africa in about 600 B.C., cited by Herodotus (IV, 42), is the first in recorded history deserving mention as an exploration. This exploration was led by Necho, King of Egypt, who had previously attempted to connect the Nile and the Red Sea by a canal through the Wadi Tumilat. His ship, manned by Phœnicians, apparently circumnavigated the continent, for they sailed until the sun "rose on their right hand" for many weeks. Thus the enormous extent of the continent was known to mankind at least six centuries before Christ. More than five centuries before, 1101 B.C., the Phœnicians had established Utica, on the northwest extremity of the present Gulf of Tunis, and in 826 B.C. they founded Carthage, 17 miles southeast. But these colonizing expeditions were merely economic manifestations of a trading people. They did not explore inland.

Possibly the greatest disadvantage confronting the explorers of pre-Christian eras was the absence of the compass, a serious barrier to ocean navigation, and likewise to desert and jungle travel. Another disadvantage, and one which has slowed modern exploration of Africa, is the topography of the continent. The Atlas Mts. in the northwest are a natural barrier to inland penetration from the convenient ports of Morocco and Algeria. The Congo, emptying below the equator on the west coast, and its tributaries extending north and south, would seem a convenient gateway into the heart of Africa. But this lengthy river rises at an elevation of 6,000 feet, between the Nyasa and Tanganyika lakes, and consequently is studded with falls on its descent to the sea. For example, Stanley Falls, although only 200 feet high, present a problem to the explorer with a pack train. The Victoria Falls stand in the way of navigation up the length of the Zambezi, emptying into the Indian Ocean. The arid stretches of the Sahara, extending across northern Africa from the Atlantic to the Red Sea and south to the Niger and Lake Tchad, together with the jungle, dry velt and their fauna, present more obvious disadvantages.

Modern exploration did not begin until the 15th

century, and the preceding expeditions may be briefly surveyed. Carthaginians journeyed to the Upper Nile, and opened caravan routes south to the Niger. Arabs entered Africa north of the Zambezi, and inland found gold mines, which have been rediscovered in the present century. The Greeks did little more than strengthen their colonies along the northern coast, and Roman interest did not extend to unknown areas. But knowledge of Africa was slowly increasing, as is borne out by the maps of the geographer Ptolemy (2nd century); these showed the course of the Nile and the Atlas Mts. with surprising accuracy. Throughout the Middle Ages exploration practically ceased.

**Modern Exploration.** It is convenient to date modern African exploration from 1415, when Prince Henry of Portugal sent the first of his successive expeditions down the African coast to find the long-cherished southern route to India. In 1441-42 Gonçalves and Tristão visited the Gold Coast, and returned with slaves. In 1482 Diogo Cão passed the Congo and learned of its length from natives. Bartholomew Dias was the first to sight the great tableland known to-day as the Cape of Good Hope in 1486. Twelve years later Vasco da Gama made his way around the cape to India.

Important as they were, such Portuguese voyages merely established the outlines of Africa. Modern inland exploration was not begun until the 18th century. James Bruce, a Scotchman, discovered the headwaters of the Blue Nile, and he organized the African Association exclusively for exploration. Under its auspices, Mungo Park, another Scotchman, traced much of the Niger. Between 1802 and 1811 two Portuguese traders crossed the continent from Angola to the mouth of the Zambezi. In 1823 three Englishmen reached Lake Tchad after crossing the Sahara from Tripoli. The discovery of the snow-clad mountains of Kenya and Kilimanjaro by missionaries in 1848-49 aroused widespread curiosity over other characteristics of southeastern and central Africa. In answer to this demand for more scientific data, David Livingstone, a missionary, in 1849 set forth over the Kalahari Desert and discovered Lake Ngami, in Bechuanaland, southern Africa, and during 1851-56 made a west-east crossing and mapped the upper system of the Zambezi. Livingstone also discovered the falls which he named after Queen Victoria, and sailed around Lake Nyasa, in Rhodesia. J. H. Speke entered an outlet of Lake Victoria Nyanza in 1862, and continuing north solved the enigma of the Nile. In 1871 H. M. Stanley rescued Livingstone at Ujiji, and after the latter's death in 1873, Stanley led an ambitious exploration which circumnavigated Victoria Nyanza and Tanganyika and traced the so-called Lualaba River to the Atlantic, thus achieving the first plotting of the great Congo.

In 1877 Portugal dispatched a party to Africa to map Angola on the west coast and in 1880-82 a German traveler, Wissman, ascended the Congo to Nyangwe, and crossed to the east coast. Two years

later the same explorer descended the Kasai, largest Congon tributary from the south. Stanley made a third African trip in 1887, ascending the Congo, crossing the equatorial forest, inhabited by the "pygmies," and discovered the Runsora mountain range. In the northwest, a Frenchman named de Foucauld thoroughly explored the Atlas chain in 1883-84. At the end of the century, a host of explorers, geographers and surveyors were concentrating on the Dark Continent. In 1898-1900 the length of Africa, Capetown to Cairo, was traversed by E. S. Grogan, an Englishman. During the present century the partition of Africa among the European powers gave rise to boundary commissions, which undertook surveying and mapping. Indeed surveying and archeology have largely supplanted exploring in Africa, for the continent has now been substantially covered by man.

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**AFRICAINNE, L'**, an opera in five acts by GIACOMO MEYERBEER, libretto by Eugène Scribe; première, Paris, London and New York, 1865. Although Meyerbeer began work on the score in 1838 he did not finish it until May 1, 1864, dying the following day. The settings are varied and elaborate, but the music, like much of Meyerbeer's, tends toward emotional superficiality and self-conscious craftsmanship.

The story deals with Vasco da Gama, the Portuguese explorer, who is betrothed to Inez, daughter of Don Diego, a noble fellow countryman. Having been away at sea for several years he is given up for lost. Meanwhile Don Pedro, president of the Portuguese Council, has sued for the hand of the fair Inez. At this juncture Vasco unexpectedly returns to Lisbon whither he brings Selika and Nelusko, natives of an island he has discovered in the Indian Ocean. Angered by the return of his rival, Don Pedro has him promptly imprisoned, but Selika, ostensibly a slave but actually an Indian princess, consoles Vasco with information regarding a secret route to the unknown land beyond Africa he had been seeking, while Inez, in order to secure Vasco's release from prison, promises to marry Don Pedro. The rivals thereupon set sail in separate ships, both intent upon discovering the unknown country. Through the treachery of Nelusko, Don Pedro's vessel is wrecked on the island coast, but Inez herself is saved and Vasco and Selika are married in a Hindu temple near her palace. The latter soon realizes, however, that Vasco's love for Inez is overwhelming, and accordingly she determines on the supreme sacrifice, ordering a ship to take the lovers homeward while she herself, seated under a poisonous manchineel tree, watches the vessel depart as she breathes in the poisonous vapors.

**AFRICAN LANGUAGES.** The native language-groups of Africa are Hamitic, Sudano-Guinean, Bantu, Hottentot, and Bushman (*see* separate articles on these subjects), mostly written in Latin characters, though Arabic letters are used in the Sudan, and the Vei and Mom have scripts of their own. The conviction that all the languages of Negro Africa come from a single Proto-African speech, supported by French specialists since 1912, is steadily gaining ground; and some believe them to be derived from ancient EGYPTIAN. In their present forms they are of varied types.

L. H.

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**AFRICAN LILY** (*Agapanthus africanus*, sometimes called *A. umbellatus*), a handsome half-hardy perennial of the lily family, native to South Africa and grown widely as a pot plant. The short stem bears a tuft of narrow leaves about 2 ft. long, from which arises a central flower stalk, 2 to 3 ft. high, ending in a cluster (umbel) of funnel-shaped, bright blue flowers.

**AFRICAN TICK FEVER.** *See* RELAPSING FEVER.

**AFTER DAMP.** *See* MARSH GAS; METHANE.

**AFTER IMAGE.** When the eyes are suddenly turned aside after having fixedly viewed a brightly illuminated object showing strong contrasts, an image of the object with the light and dark portions interchanged will be perceived for some seconds. This is known as the after image. This phenomenon is due to fatigue of the retina. When the object is being viewed, the parts of the retina on which the brighter components of the object are imaged become fatigued and less sensitive to light than the parts on which the darker components of the object are imaged. If the eyes are now quickly directed at a surface approximately uniformly illuminated, the portions of the retina which are fatigued, being less sensitive, register the incident light less strongly on the consciousness than do the more sensitive portions. Consequently, the negative of the original object is seen. If the original object is brightly colored, the after image will appear in complementary colors. The explanation is similar to that given, except that the retina becomes selectively fatigued to certain spectral regions. As soon as the retina recovers its uniform sensitivity to light, the after image disappears.

**AFYON-KARAHISAR**, also **AFION-KARAHISSAR**, a city of Turkey in Asia Minor, about 200 mi. northeast of Smyrna with which it is connected by rail, as well as with Konia, Angora and Constantinople. A ruined Byzantine castle stands on one of the rocky hills around the town. Afyon-Karahisar is a manufacturing center for woolen carpets and saddles. It gets its name from opium, which is the main item of trade. Called Nicopolis after Leo III's victory over the Arabs in 740, the city was renamed Kara-Hissar by the Seljuk Turks. Pop. 1927, 102,263.

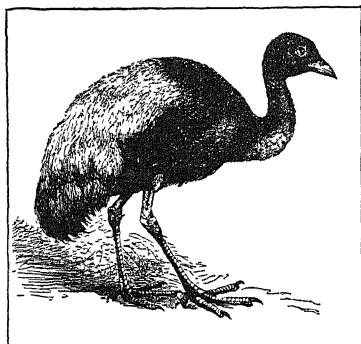
**AGADIR AFFAIR**, an international dispute between France and Germany in 1911-12 leading into



the Second Morocco Crisis. On the basis of the Algeiras agreement in 1905 French forces entered Morocco to restore order. Entering Fez, the capital of Morocco, they remained, arousing the Germans who claimed that France had violated the terms of Algeiras, and sent the *Panther* to Agadir. The gunboat was too small to have undertaken any occupation of Moroccan territory, but her visit served to bring matters to a crisis which on Nov. 4, 1911 nearly brought on war. A compromise was effected, however, and out of this second Morocco crisis came the adjustment of the Moroccan question in which Germany recognized French *de facto* possession of Morocco in return for Cameroon, a section of the French Congo. The incident served also to indicate the certainty of British support behind France.

**AGAMEMNON**, son of Atreus, king of Mycenae and brother of MENELAUS. For his history see ATREIDES; ILIAD.

**AGAMI**, the name given in Brazil to one of a family (*Psophiidae*) of seven species of Trumpeters, which are related to the cranes but which have been described as looking like long-legged black guinea-fowls. The Trumpeters inhabit the Amazon country, going in flocks of several hundreds through the forests, and running, rather than flying, to escape pursuit. The Common Trumpeter, or Agami (*Psophia crepi-*



AGAMI OR TRUMPETER

*tans*) is about 21 in. long, black except for a purple throat and rusty brown wing coverts. Its deep booming cry is not very trumpet-like. The female lays 10 or more bantam-like eggs in a nest on the ground. In captivity it is gentle, but does not breed. Its loud note often serves as a warning of danger to the flocks of its owner.

C. J.

**AGAMI HERON**, a handsome South American member of the world-wide family of herons, which number about 100 species. The Agami heron (*Agamia agami*) is about 32 in. long, in size half way between the great blue heron and the green heron of the United States, and in color somewhat resembling the latter. It is glossy dark green above, with chestnut neck and lower parts, with gray plumes on the lower back and a crest. Commonest in Brazil, the Agami heron is found as far north as Mexico and west to Peru. Like all herons, it feeds on fish, frogs, grasshoppers and other small animals.

C. J.

**AGAPE**, a Greek word, meaning love, used to signify a love feast. From time immemorial a banquet has been an occasion, at once social and sacred, which transcends the mere use of material food. In Greece and Rome, trades and other guilds instituted such suppers of which, in the Hebrew religion, the Passover and the Feast of Tabernacles are analogous instances. In the early Church the Christians met at the agape, and the separate ceremonial and mystical celebration of the EUCHARIST was not always clearly defined (I Corinthians 11:20-21). Tertullian describes the agape as a meal, beginning and ending with prayer, at which the poorest are fed and no more of food and drink are consumed than will satisfy the appetite. The hands are washed, the lamps are lighted, and each person is encouraged to sing a hymn, either Scriptural or of his own composition. Under Trajan and other Emperors such meetings, pagan or Christian, were regarded as possible centers of sedition; and Pliny, finding that the Church held no license to hold such meetings, forbade the agape in Bithynia. The Council of Gangra (343?) condemned the ascetic view which denounced agapes; and the councils of Laodicea, 363, Carthage, 388, and Trullo, 692, prohibited holding agapes in church. In Protestant bodies there are many social occasions distinct from the Sacrament itself, which recall the essentials of the agape; an example may be found in the Church Supper.

**AGAPETUS**, a name taken by two popes. Agapetus I, Pope from 535 to 536, aided in founding an ecclesiastical library at Rome. He was sent by Theodahad, the Ostrogoth king, to Constantinople. While there he persuaded the Emperor Justinian to depose Anthimus, the Patriarch of Constantinople. Agapetus I died while on this mission. Agapetus II, Pope from 946 to 955, attempted to regain for the Church the temporal powers it had lost to Alberic, the self-named prince and senator of the Romans. Agapetus II's appeals to Otto the Great for intervention were answered only after his death.

**AGAR AGAR**, a gelatinous substance derived from several East Indian seaweeds, made chiefly in Japan and China, and used in the Orient in various foods. It now finds favor as a laxative. Japanese agar agar is important as a culture medium for growing bacteria in the laboratory.

**AGASSIZ, LOUIS** (Jean Louis Rodolphe), (1807-73), naturalist, was born at Motier, Switzerland, of Huguenot parentage, May 28, 1807. After early studies in Switzerland he attended the Universities of Zurich, Heidelberg and Munich, concentrating his attention on zoölogy. His attention was drawn to fossil fishes and he continued his studies at Paris. Later as professor at Neuchatel he published from 1832 to 1842 his *Recherches sur les poissons fossiles*, in which he classified more than 1,000 extinct species. Soon afterwards he began a much needed classification of nomenclature of fossil species and then turned his attention to glaciers, publishing in 1840 his *Études sur les glaciers* in which he stated his discovery that the

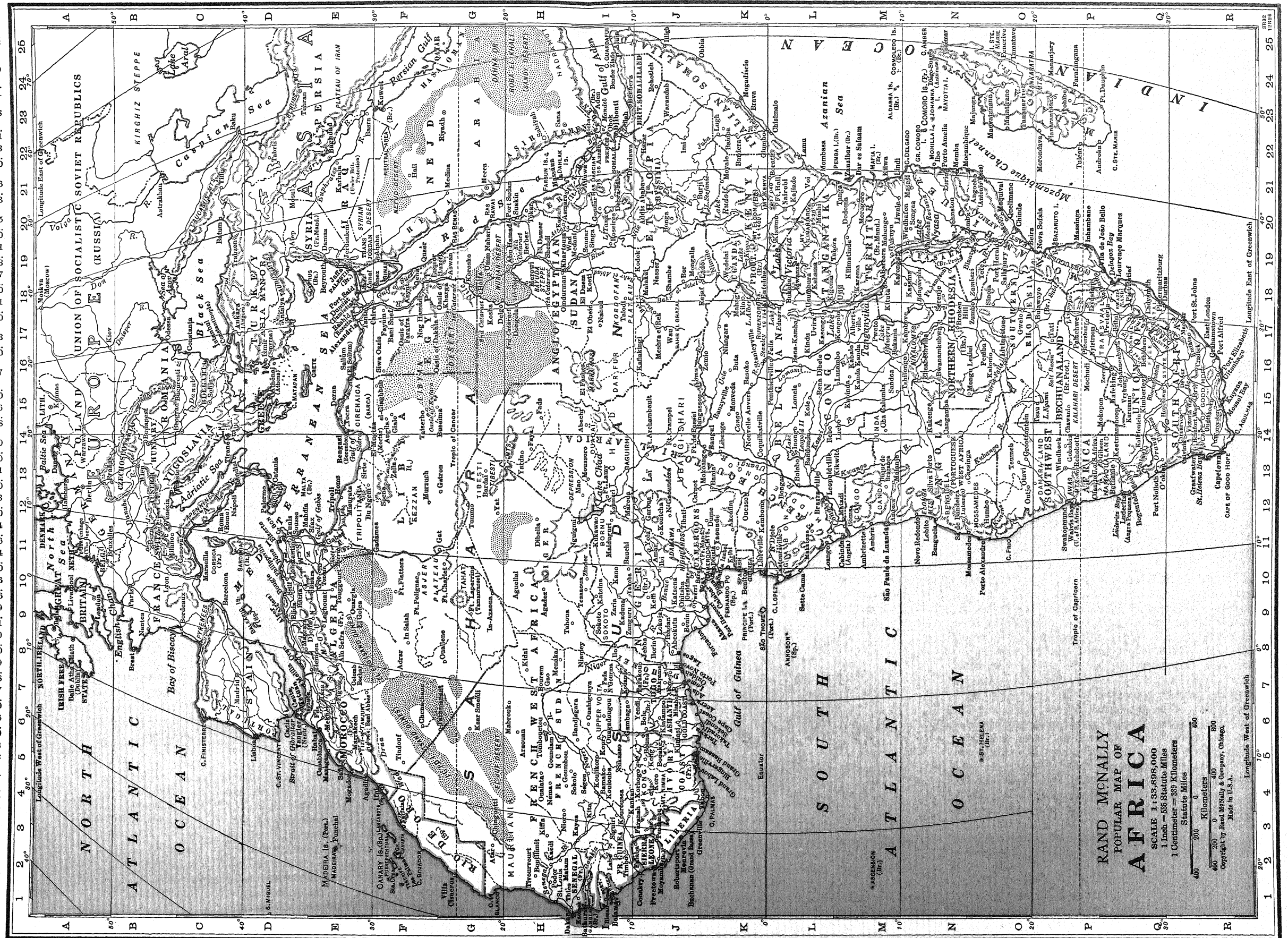


# AFRICA

Area  
11,402,325 sq. m.  
Pop. 142,094,352

## COUNTRIES

ALGERIA.....E 9  
Area 847,307 sq. m.  
Pop. 6,553,451  
ANGLO-EGYPTIAN  
SUDAN.....H 18  
Area 1,008,100 sq. m.  
Pop. 6,469,041  
ANGOLA.....N 13  
Area 484,729 sq. m.  
Pop. 2,600,000  
BECHUANALAND.....P 16  
Area 275,000 sq. m.  
Pop. 152,983  
BELGIAN CONGO.....L 15  
Area 920,656 sq. m.  
Pop. 10,000,000  
CAMEROONS.....J 11  
Area 166,489 sq. m.  
Pop. 1,877,113  
EGYPT.....F 17  
Area 383,000 sq. m.  
Pop. 14,493,000  
ETHIOPIA.....J 21  
Area 350,000 sq. m.  
Pop. 12,000,000  
FR. EQUATORIAL  
AFRICA.....J 13  
Area 982,049 sq. m.  
Pop. 3,127,700  
FR. WEST AFRICA.....H 7  
Area 1,443,332 sq. m.  
Pop. 14,318,550  
GOLD COAST.....J 6  
Area 91,690 sq. m.  
Pop. 3,163,568  
GUINEA, SPANISH.....K 10  
Area 10,860 sq. m.  
Pop. 140,000  
KENYA.....K 21  
Area 245,060 sq. m.  
Pop. 3,003,150  
LIBERIA.....J 3  
Area 43,000 sq. m.  
Pop. 2,250,000  
LIBYA.....F 14  
Area 633,040 sq. m.  
Pop. 719,266  
MADAGASCAR.....O 24  
Area 228,707 sq. m.  
Pop. 3,853,300  
MOROCCO.....E 6  
Area 231,500 sq. m.  
Pop. 4,229,146  
MOZAMBIQUE.....O 19  
Area 426,492 sq. m.  
Pop. 3,995,831  
NIGERIA.....I 10  
Area 336,778 sq. m.  
Pop. 19,409,000  
NYASALAND.....N 19  
Area 37,890 sq. m.  
Pop. 1,359,998  
RHODESIA, N.....N 17  
Area 291,000 sq. m.  
Pop. 1,344,000  
RHODESIA, S.....O 16  
Area 149,000 sq. m.  
Pop. 1,092,400  
SIERRA LEONE.....J 2  
Area 31,000 sq. m.  
Pop. 1,672,057  
SOUTHWEST AFRICA.....P 13  
Area 322,393 sq. m.  
Pop. 268,105  
TANGANYIKA.....L 19  
Area 366,632 sq. m.  
Pop. 4,825,064  
TUNISIA.....E 11  
Area 48,300 sq. m.  
Pop. 2,159,708  
UGANDA.....K 19  
Area 94,204 sq. m.  
Pop. 3,410,857  
UNION OF SOUTH  
AFRICA.....Q 15  
Area 472,347 sq. m.  
Pop. 8,250,000



RAND McNALLY  
POPULAR MAP OF  
AFRICA

SCALE 1:33,898,000  
1 inch = 538 Statute Miles  
1 Centimeter = 33 Kilometers

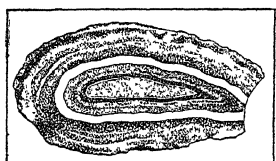
Statute Miles  
Kilometers

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existing glaciers of Switzerland were remnants of a great sheet which once covered the entire country. In 1846 he visited the United States and in 1847 became professor of zoology at Harvard University. In America he continued his researches, publishing much valuable matter on zoology and geology, and greatly improved the teaching of natural science. He founded and fostered the zoological museum (now the Agassiz Museum) at Harvard. Darwinian evolution (*see* C. R. DARWIN) never seemed to him consistent with the facts of zoology as he saw them, and he never accepted it. He died at Cambridge, Mass., Dec. 14, 1873.

**AGATE**, a popular variety of **CHALCEDONY**, or cryptocrystalline **QUARTZ**, which shows various colors either in bands, clouds or veinlets. These colors are usually in straight or wavy parallel bands, or disposed in concentric, almost circular or elliptical rings. Impurities in the quartz,

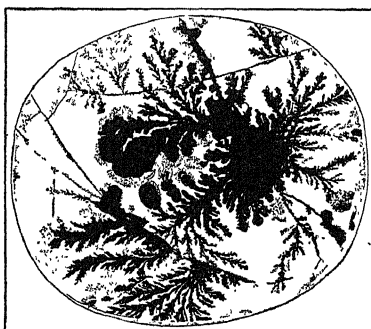


FROM KRAUS AND HOLDEN, GEMS AND GEM MATERIALS, MCGRAW HILL.

CROSS SECTION OF AGATE, SHOWING VEINING

Variations in the composition of the solutions, or in conditions of heat and pressure under which precipitation takes place, cause the variegated character of the stone. In nature the colors are seldom vivid, and a particularly brilliant specimen can usually be assumed to have been artificially stained with dyes and chemicals.

When colored in wavy but parallel layers, the stone is called banded **AGATE**. **ONYX** is the name applied when the bands are quite flat. When they are angular, resembling battlements, it is called fortification agate.



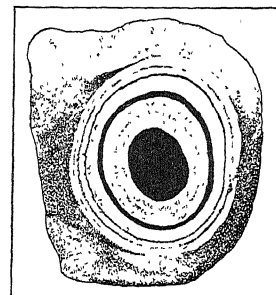
COURTESY AMER. MUS. OF NATL. HISTORY

MOSS AGATE

Moss agates show inclusions of dark material in dendritic shapes, resembling moss and ferns. Frequently a coloration in concentric rings produces a resemblance to an eye, whence the name eye-agate. Clouded **CHALCEDONY** sometimes replaces the woody material of buried trees producing petrified or agat-

ized wood. The name clouded agate is self-explanatory. All these forms are cut and polished for ornaments and jewelry.

Germany, Uruguay and Brazil and the Lake Superior district provide good specimens. Agatized wood is found in the Petrified Forest of Arizona. The Achates River in Sicily yielded the first specimens, for which the stone was named, according to Pliny. *See also* **GEM STONES**; **MOCHA STONE**.



FROM KRAUS AND HOLDEN, GEMS AND GEM MATERIALS, MCGRAW HILL.

EYE AGATE  
Cross section

**AGATE LINE**, a unit for measuring advertising space, based upon the type size known as agate, fourteen lines of which make one inch. It is approximately equal to 5½ point in the modern POINT SYSTEM.

**AGATHA, ST.**, a virgin martyr in Sicily, possibly during the persecution of the Emperor Decius, 201-251. Reared in a wealthy home, the beautiful maiden was pursued by Senator Quintianus, prefect of the island, whose love turned to hate when it was refused. The girl was committed to an evil woman, but retained her purity. Her ferocious enemy, unmoved by her allusions to his own mother, cut off her breasts, which mutilation, cured by St. Peter, appears frequently in medieval art. She was also tortured on the rack. Finally she succumbed, her relics being preserved at Catania, a town that disputed with Palermo the honor of being her birthplace. Crowned above her veil, she is painted serene, a clasped book in her left hand and a palm branch in her right.

**AGATHO, ST.** (?-681), elected pope in 678, was born in Palermo, Sicily. He was the first pope who refused to pay tribute to the emperor at Constantinople on election. In 679 he ordered St. Wilfred restored to his bishopric at York. He brought about the 6th Ecumenical Council at Constantinople in 680, when the heresy of the **MONOTHELITES** was condemned. He died in 681.

**AGAVE**, a group of numerous striking plants of the **AMARYLLIS** family, containing some 300 species, native to arid parts of the Western Hemisphere. They have very large, stiff, heavy, fleshy leaves, bearing sharp marginal teeth and ending in a strong spine. The leaves, which often persist many years, are usually arranged in a basal rosette from which arises a tall flower stalk crowned with clusters of showy flowers. About 20 species occur in the southwestern United States. In Mexico several species are of high economic value, furnishing the liquors pulque and mescal and the fiber sisal. *See* **CENTURY PLANT**; **SISAL HEMP**.

**AGE GRADES**, in anthropology. Among many primitive tribes individuals are grouped in age classes which grouping, parallel to other distinctions such as

the basic one of sex, or the more artificial clan or gens, has a large influence on the social status of the individual. Among the Australian blacks, for example, great stress is laid upon this age classification for men, so that from boyhood to middle age the individual passes from one initiation to another, each in turn opening up for him new duties and new social responsibilities. Even among many primitive groups where these age classifications do not reach extreme elaboration, the almost universal puberal ceremonies for girls and boys demonstrate that some such classification plays a part in the social structure.

**AGEING TESTS.** See **TIME, EFFECT OF.**

**AGENTS, BUSINESS,** officials of local trade unions (see **LABOR ORGANIZATIONS**), usually on full-time salary, whose function is to act as field representatives of their organizations. They inspect working conditions, interview employers and shop committeemen, and adjust minor disputes. They sometimes report the establishment of new places of employment.

**AGGEUS, BOOK OF,** is accounted by the Catholic Church to be the 10th of the books of the minor prophets. See **HAGGAI, BOOK OF.**

**AGGLOMERATE,** in geology, a rock made up of angular pieces of **LAVA**, or other rocks, in a matrix of **TUFF**. It is a result of volcanic explosions shattering previously solidified lava, or other neighboring formations, the ejected fragments accumulating with more finely comminuted material, or tuff. Eventually this consolidates into solid rock, a result of compaction or of cementing together material such as silica, deposited from circulating solutions. See also **VOLCANO; VOLCANISM.**

**AGGLUTINATION,** a process of **INFLECTION** in which inflectional elements are attached to the word-stem without losing their identity. It is regarded as especially characteristic of the Turco-Mongol-Tungus and Finno-Ugric (see separate articles on these subjects), linguistic families, e.g., **TURKISH** *en* "come down," *dir* causative element, *mek* infinitival sign, giving *en-mek*, *en-dir-mek*, "to come down, to make come down," etc.; but it occurs frequently in many other families as well. It is possible, though as yet scarcely demonstrable, that inflection itself arose from an earlier system of agglutination, the agglutinative elements having suffered such attrition in their passage to true inflection that they can comparatively rarely be isolated with mechanical precision. L. H. G.

**AGGREGATE,** a general term applied to those inert, i.e., chemically inactive, materials, both fine and coarse, which, when bound together by cement, form the substance known as **CONCRETE**. Fine aggregates are materials such as natural sand or rock screenings. Coarse, or large aggregates, or ballast, are materials such as natural **GRAVEL**, crushed rock, or by-product materials such as cinders or crushed blast-furnace **SLAG**.

The surface of gravel is usually very rough; and from considerations of character of surface presented for adhesion of cement, it produces a good concrete,

provided it is clean and of good mineral quality. Crushed rock, as the name implies, is the product obtained by the reduction of rock to smaller sizes by the use of a rock crusher. For use in concrete work, the rocks should be of durable character, sound, clean, hard, and free from objectionable minerals. They should be of such a quality that they do not tend to disintegrate when exposed to heat or weathering.

**AGGREGATION,** a collective term indicating the massing together of **ATOMS**, **MOLECULES** or combinations of molecules into a gaseous, liquid or solid state. An aggregate of molecules is a combination of molecules which may exist in any of these states. These aggregates may be broken up in various ways, the most common being by heat. If a solid is heated, the molecules are put into a state of thermal agitation (see **KINETIC THEORY**), which causes the mean distance between their centers to become larger and larger. Finally, a condition occurs where the solid fuses and passes into the liquid state. If the liquid now be further heated, a somewhat similar process goes on between the molecules until, on further separation, evaporation occurs and the material passes into the vapor or gaseous state.

This general statement would seem to be contradictory to the fact that water at 4°C. is denser than it is in the solid state at 0°C. This is accounted for by what is known as association of molecules, i.e., groups of two, three or more molecules of water form an association under one condition and not under the other, which gives rise to this change in density.

**AGINCOURT, BATTLE OF,** Oct. 25, 1415, a celebrated action between English and French men-at-arms, which took place in a defile near the town of Agincourt (Azincourt), in the present department of Pas de Calais, France. Setting out to conquer France, Henry V of England landed at Harfleur, which he captured, and began marching toward Calais, where he hoped to winter. The French, under Charles d'Albret, constable of France, blocked the invaders with a strong force, forcing Henry to retreat to the Somme. D'Albret pursued the English king and forced him to accept battle, though he had only approximately 14,000 troops to oppose the French force of 50,000. The English, however, possessed the advantage of better arms and greater flexibility. In the ensuing battle, the French lost 5,000, including the constable, and the English about 115. Agincourt showed that a deployed and mobile battle-front is immensely superior to the immobile, heavily armored line of medieval custom.

**AGIO,** a term used to designate the difference in value between paper money and the metallic currency upon which it is based; also, the depreciation in the value of coinage due to wear; and the premium paid for an amount of money in a more convenient form.

**AGITATION, THERMAL.** According to the **KINETIC THEORY** of matter, the molecules within a body are in constant motion. This motion, which depends upon the absolute temperature of the body



(see ABSOLUTE TEMPERATURE SCALE), is called thermal agitation to distinguish it from molecular motion due to other causes.

**AGLAIA**, one of the three GRACES.

**AGLIARDI, ANTONIO** (1832-1915), cardinal of the Catholic Church, was born at Cologno in 1832. On completion of his studies at Rome he went to Canada as bishop. In 1884 he went to Palestine as Archbishop of Caesarea. In the Goa controversy with Portugal he was apostolic delegate in India. He was papal nuncio to Munich in 1889 and to Vienna in 1893, and was made a cardinal in 1896. Agliardi died at Rome in 1915.

**AGNES, ST.**, a virgin martyr of Rome whose symbol, expressed in her name, is a lamb. At the age of 12 years she encountered the persecution, possibly of Diocletian, and in 304 was sentenced by the



COURTESY METROPOLITAN MUSEUM OF ART

SAINT AGNES

After the engraving by Martin Schongauer

judge to a house of ill-fame. A man, approaching her there, was struck with blindness. Agnes was burned alive or decapitated. St. Agnes Church in Rome covers the saint's grave and, with a mosaic of her in the apse, remains as left by Pope Honorius, 625-638. Here on the date of her martyrdom, Jan. 21, two lambs are blessed by the Pope, and their wool is used in weaving the pallia presented to archbishops.

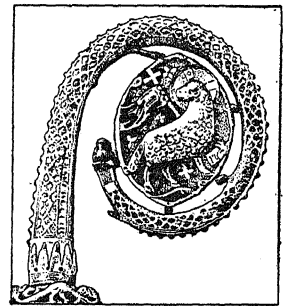
**AGNEW, WILLIAM HENRY** (1881- ), American educator, was born at Westphalia, Kan., Oct. 12, 1881. He graduated from St. Louis University in 1905 and was ordained a priest in the Roman Catholic Church in 1915. He served as dean of the department of science and mathematics at Loyola University, and at St. Louis University, and from 1921-27 was president of the former institution. In 1928 he became president of Creighton University.

**AGNI**, fire god of the Hindus, represented with two faces, seven arms and three legs. He is sometimes identified with Rudra, the god of lightning.

**AGNOETAE**, a section of the MONOPHYSITES who held that Christ was not omniscient. In Mark 13, 32, Our Lord stated that like the angels he was unaware of the day and hour when heaven and earth should pass away, and in Luke 2, 46, we see Jesus in the temple asking questions of the doctors. The Agnoetae were condemned by GREGORY THE GREAT. A variant of the same limitation to Christ's faculties is based on the statement in Phil. 2, 7, that Jesus, though Deity, "emptied himself" (Revised Version) and during his humiliation, voluntarily surrendered his omniscience.

**AGNOSTICISM**, a label coined by THOMAS HUXLEY to designate his attitude towards ultimate questions. The agnostic is one who writes, "I do not know" across the question of the nature of the universe. Although agnosticism may stand for any type of philosophy which is sceptical or considers a knowledge of reality impossible, in its usual meaning the term has come to signify an attitude with reference to the existence of God. This modest attitude of doubt and uncertainty of knowledge on the point may be contrasted with that of the theist on the one hand, and the atheist on the other. The theist would assert positively that he knows there is a God; the atheist is equally emphatic in denying the deity's existence; the agnostic merely says he does not know. This is an attitude widely held by thinking persons at the present time. The new physics and the new astronomy are giving rise to cosmic conceptions that baffle the imagination of man. Hence the prevalence of agnosticism.

**AGNUS DEI**, a lamb bearing a cross, symbolic of Christ. Originally discs with this design were made out of the preceding year's paschal candle, a custom dating from the 9th century. In the first year of each Pontificate and every seventh year after, such discs are blessed by the Pope on Wednesday of Easter week and distributed on the following Saturday. The term *Agnus Dei* also denoted the invocation in the Mass, translated "Lamb of God that taketh away the sins of the world, have mercy on us."



COURTESY M. M. OF ART

AGNUS DEI, MADE OF CHAMPLEVÉ ENAMEL ON COPPER, FRANCE, 1250-1300

**AGONIC LINES.** See DECLINATION, MAGNETIC.

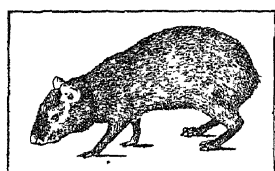
**AGORA**, literally the market-place, in fact the center of commercial, political, and social life of the city, corresponding to the Forum of Roman times. The agora at Athens was enclosed by colonnades, including the painted porch with frescoes of battle scenes of the Persian wars; around it were many important public buildings and temples. The agora lies northwest of the Acropolis, near the Temple of Hephaestus, and was until 1930 entirely covered by the modern city of Athens. The American School of Classical Studies, with the cooperation of the Greek



government, is now engaged in an extensive archaeological research of this area.

**AGORACRITUS**, a noted Greek sculptor of the 5th century B.C. His great masterpiece was the large temple statue of Nemesis at Rhamnus, said to have been carved from a block of Parian marble brought by the Persians to Marathon for a trophy of victory. Fragments of this statue are still in existence, having been found in 1890.

**AGOUTI** (*Dasyprocta*), the American name of several species of slender-limbed rodents, ranging from Mexico to Paraguay, in appearance not unlike tiny hornless deer. Agoutis are agile, fleet and wary, little



COURTESY N. Y. ZOOLOGICAL SOCIETY

AGOUTI

larger than rabbits, in color sooty brown or rufous, with pointed heads, large eyes, and short ears and tails. They differ from the related pacas in having but three toes upon the hind foot. Living entirely in forests upon the ground, they hide by day, feeding at night upon nuts, roots, and green vegetation. They might become pests on sugar plantations, were not agouti-meat highly esteemed, so they are relentlessly hunted as game.

**AGRA**, capital city of the district of Agra in British India, which embraces the central part of the fruitful Jumna-Ganges-Doab. It is situated at a sharp bend in the Jumna, 45 mi. west of Bharatpur. Its most prominent feature is the imposing fort, whose broad front faces the river, and in and about which are splendid buildings of the purest Mohammedan architecture. Among them are The Pearl, the great mosque, the palace and audience hall of Shah Jehan; a mile and a quarter beyond the fort, on the river, is the **Taj Mahal**, "a dream in marble," the mausoleum of the shah's favorite wife. A large industry in hand-made articles and a heavy trade in a variety of commodities are carried on. Of the inhabitants, two-thirds are Hindus and one-third Mohammedans. Pop. 1921, 180,000; 1931, 230,190.

**AGRAM** or **ZAGREB**, capital of Croatia and, next to Belgrade, the largest and most important city in YUGOSLAVIA. Located near the Sava River, at the base of Mt. Zagreb, estates and vineyards enclose the city. In the older quarter are a 15th century Gothic cathedral and an episcopal palace. The business section of the city, the Palace of Justice, the educational institutions, churches, the national theater and many other state and civic institutions are in the newer part. It has considerable trade in grain, wine and tobacco, and manufactures leather, linen, porcelain, carpets, silk, caps and hats, paper, boots, varnish, chemicals and oil colors.

The city is believed to have been founded in Roman times, but its history dates from the 11th century. At that time it became the seat of a bishop under King Ladislaus of Hungary. In 1867 it was chosen as the capital of Croatia-Slavonia and has consistently spon-

sored South-Slav political and cultural movements. It is not identified with the movement for an independent Croatia. Upon the disruption of the Austro-Hungarian Empire after the World War Zagreb became the capital of the Croatian province and one of the five military provinces of the Yugoslav kingdom has its headquarters there. Recently Zagreb has been the scene of repeated political disturbances by the Croat Nationalists and members of the patriotic-athletic societies known as Yugoslav Sokols. Pop. 1931, 185,581.

**AGRAPHIA**, an utterance ascribed to Christ but not included in the four Gospels; for instance, Acts 20:35, "It is more blessed to give than to receive." See I Timothy 5:18; I Corinthians 7:10-12, dealing with divorce.

**AGRICOLA, GEORG** (1494-1555), German scholar and scientist, was born at Glauchau, Mar. 24, 1494. Agricola is regarded as the founder of modern mineralogy. His most important work, *De re metallica*, is a systematic treatise on mining and metallurgy. A translation by Mr. and Mrs. Herbert Hoover was published in 1912. Agricola died at Chemnitz, Nov. 21, 1555.

**AGRICOLA, GNAEUS JULIUS** (37-93), Roman general and governor, was born at Forum Julii (now Fréjus), southern France, in 37 A.D. After serving in Britain, Asia and Aquitania, at 41 he became governor of Britain, where he erected strong fortifications and was unusually successful in overcoming resistance from the natives. Jealousy of the general's victories caused the Emperor Domitian to recall Agricola in 84. Thereafter he lived in retirement and died perhaps from poisoning, in 93. **TACITUS**, the great Roman historian, was Agricola's son-in-law.

**AGRICULTURAL CREDIT** does not differ in principle from **CREDIT** in business and industry. There are, however, practical problems that call for special consideration. The farmer, like any producer, requires long term investment credit and short term working credit. The former is applied to the purchase of land and to creating fixed improvements. Working credit is used for buying seed, fertilizer, a breeding herd, for paying wages, or for carrying a crop until it can be marketed. The corresponding credit needs in other lines of production are met by the issue of corporate securities for investment funds and by borrowing from the commercial **BANKS** for working funds.

The unincorporated farm secures long term credit by borrowing on the security of the **LAND**, the lender receiving a **MORTGAGE**. The risks involved in such loans are complicated by the unstandardized nature of the security and by the hazards of regional drought and crop failure. The farmer-borrower, accordingly, does not readily tap the main markets of loanable funds and has had to take loans on less favorable conditions, paying high **INTEREST** and commissions. In Europe, where agriculture is more stabilized than in the United States, where land speculation is practically unknown, and the spirit of individualism not so strong, some of these difficulties have been surmounted

by the cooperative action of the agricultural producers, all members of a group being jointly responsible for loans received by any members. The FEDERAL FARM LOAN ACT passed in 1916 makes cooperative borrowing by farmers a prominent feature.

The basis of the farmer's difficulty with short term credit is his longer turn-over. Where 30-, 60-, or 90-day paper can provide working funds for the business man or manufacturer, six months to two or three years is needed for a crop to reach maturity and be harvested or for live stock to be produced. These needs the commercial banks could meet only at the risk of tying up their funds. The FEDERAL RESERVE SYSTEM makes various concessions, such as granting the privilege of REDISCOUNTING agricultural paper of longer duration. There was nevertheless a real gap in the credit system until the enactment of the legislation in 1923 which established the intermediate credit banks as a part of the FEDERAL FARM LOAN. These banks rediscount paper of this type for other credit organizations and make direct loans to agricultural cooperatives. C. E.

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**AGRICULTURAL ECONOMICS**, that union-zone of agricultural and economic science which treats of people in farming occupations in their individual and collective efforts to produce and exchange or otherwise make acquisitions for farm use and for family and individual consumption and to participate in the economic life of state and community. It deals with relations between the factors of agricultural production, i.e., with risk-taking enterprising, labor, capital goods and land. It is concerned with information helpful in the arts of farm organization and operation, market organization and operation, governmental policy-making and administration and individual living and community development.

Contributions to knowledge in this field have been made from widely different sources, including individual farms and groups of farmers giving attention to problems in PRODUCTION AND TRADE, MARKETING and other fields, tax-supported and other educational institutions, the Bureau of Agricultural Economics and other branches of the Federal Government, and state departments concerned with regulatory and related administrative service.

The U. S. Bureau of Agricultural Economics emphasizes research and regulatory and extension activity. Crop and livestock estimating, begun in the Patent Office in 1839, studies in farm management and farm practice, begun in the Bureau of Plant Industry about 1900 and developed in the Office of Farm Management and later in the Office of Farm Management and Farm Economics; and investigations concerning marketing, begun about 1906, and given prominence in the Office of Markets and Rural Organization, the Bureau of Markets, and the Bureau of Markets and Crop Estimates, were all brought into the Bureau of Agricultural Economics in 1922.

Under the stimulus of the Purnell Act, 1925, the

state work in agricultural economics has gone forward rapidly in agricultural experiment stations. In 1924-25 the stations reported 200 research projects or problems of investigation in this field. By the end of five years the number reached 463. Subjects emphasized are farm management, marketing, agricultural prices, land economics and farm taxation.

As early as 1867 the Massachusetts Agricultural College offered courses designated as Farm Management by Lectures and Bookkeeping and Farm Accounts. In 1897 the American Economic Association gave some attention to agricultural economics. The American Farm Management Association, 1910, and the Association of Agricultural Economists, 1916, were merged in Jan. 1919, by the former taking the name American Farm Economics Association and broadening its scope. This association, with a membership of about 1,000 has been among the most dynamic of professional organizations.

Two international conferences of agricultural economists, one at Dartington Hall, Totnes, Devon, England, in 1929, and the other at Cornell University, Ithaca, New York, in 1930, have led to formal organization for future meetings.

Problems susceptible of analysis by the aid of statistical methods have been treated with increasing satisfaction by agricultural economists. Pressure to make contributions toward legislative and other policies for rural betterment has been increasing.

Not unlike chemistry, economics has been serving agriculture in many departmental fields and to a certain extent its method and spirit have been widely assimilated, not only by workers in institutions of learning, but by others giving attention to economic problems, private and public. See also AGRICULTURAL RESEARCH; AGRICULTURAL SOCIETIES. C. L. S.

**AGRICULTURAL EDUCATION**. The rise of formal agricultural education beyond mere apprenticeship training was dependent upon the development of applied sciences about the beginning of the 19th century. The names of such men as Lavoisier, Sir Humphry Davy, Liebig and Benjamin Silliman are of as great importance in agricultural education as in their own particular fields of research.

**Early Beginnings.** Schools of agriculture below the college level began to appear early in the 18th century. The earliest seem to have been established in Bohemia and Hungary largely through the interest of Maria Theresa, and in Prussia through Frederick the Great. In 1806 an agricultural school, already begun at Celle in 1802, was opened at Moeglin, near Berlin, by Albrecht Thaer and in 1824 became the Royal Academy of Agriculture, the model of many other similar institutions. Chairs in agriculture were established at Rostock in 1790 and at Jena in 1826, but the fuller development of higher education in this field in Germany did not take place until after 1862.

Fellenberg's institution at Hofwyl, Switzerland, 1797, provided training in both industries and agriculture and became the model of similar schools in

Europe and the United States. The provision of agricultural schools in France was urged by Abbé Rosier in 1775 and Lavoisier in 1789. Such a school was founded by Dombasle at Roville in 1818, followed in 1827 by the Royal Agronomic Institution at Grignon. Farm schools and regional schools began to be provided after 1848.

Despite the establishment of a chair in rural economy at Oxford, 1796; of a chair of agriculture at Edinburgh, 1790, and of an agricultural college at Cirencester, 1840, the progress of education in this field was slow until county councils of England were permitted to use local taxes for this purpose under the Local Taxation (Customs and Excise) Act, 1890. Better facilities were afforded in Ireland, where the first school was opened at Templemoyle in County Derry in 1827, and a graded system of lower and intermediate schools, and a higher institution as well as chairs of agriculture in university colleges had been established by 1851.

**The United States.** The importance of agriculture was early recognized in the United States both in the literature on the subject and the founding of agricultural societies. A chair in natural history, chemistry, and agriculture was created at Columbia College in 1792. The earliest practical school of agriculture was the Gardiner Lyceum opened in Maine in 1823 with state grants, followed in 1825 by one at Derby, Conn. Between 1825 and 1845 numerous manual training institutions, teaching industry and agriculture on the model of Hofwyl, were established. State agricultural colleges began to be created in the second half of the century, in Michigan in 1857 and in Maryland and Pennsylvania in 1859. The most important impetus to the spread of agricultural education came from the Federal Land Grant Act, better known as the Morrill Act, passed in 1862 after several years of agitation in which Prof. Jonathan B. Turner was the moving spirit. The Second Morrill Act, 1890, and the Nelson Act, 1907, provided additional grants. Experiment stations, founded by many states after 1875, received Federal aid under the Hatch Act, 1887, and later under the Adams Act, 1906, and the Purnell Act, 1925. Extension work in agriculture and home economics was stimulated by grants under the Smith-Lever Act, 1914, and the Capper-Ketcham Act, 1928. Federal aid for vocational education, including training in agriculture, was provided in 1917 under the Smith-Hughes Act. The George-Reed Act, 1929, provided further aid for agricultural and home-making education.

A great variety of opportunities are provided for agricultural education at different levels. The rural elementary schools, while they avoid any attempt to give vocational training, base their work as far as possible on the rural environment. Similarly the junior high schools in rural areas offer some courses with an agricultural bias. The tendency is to postpone vocational training as long as possible. In general the provision for agricultural education, mainly under the provisions of the Smith-Hughes Act, fall

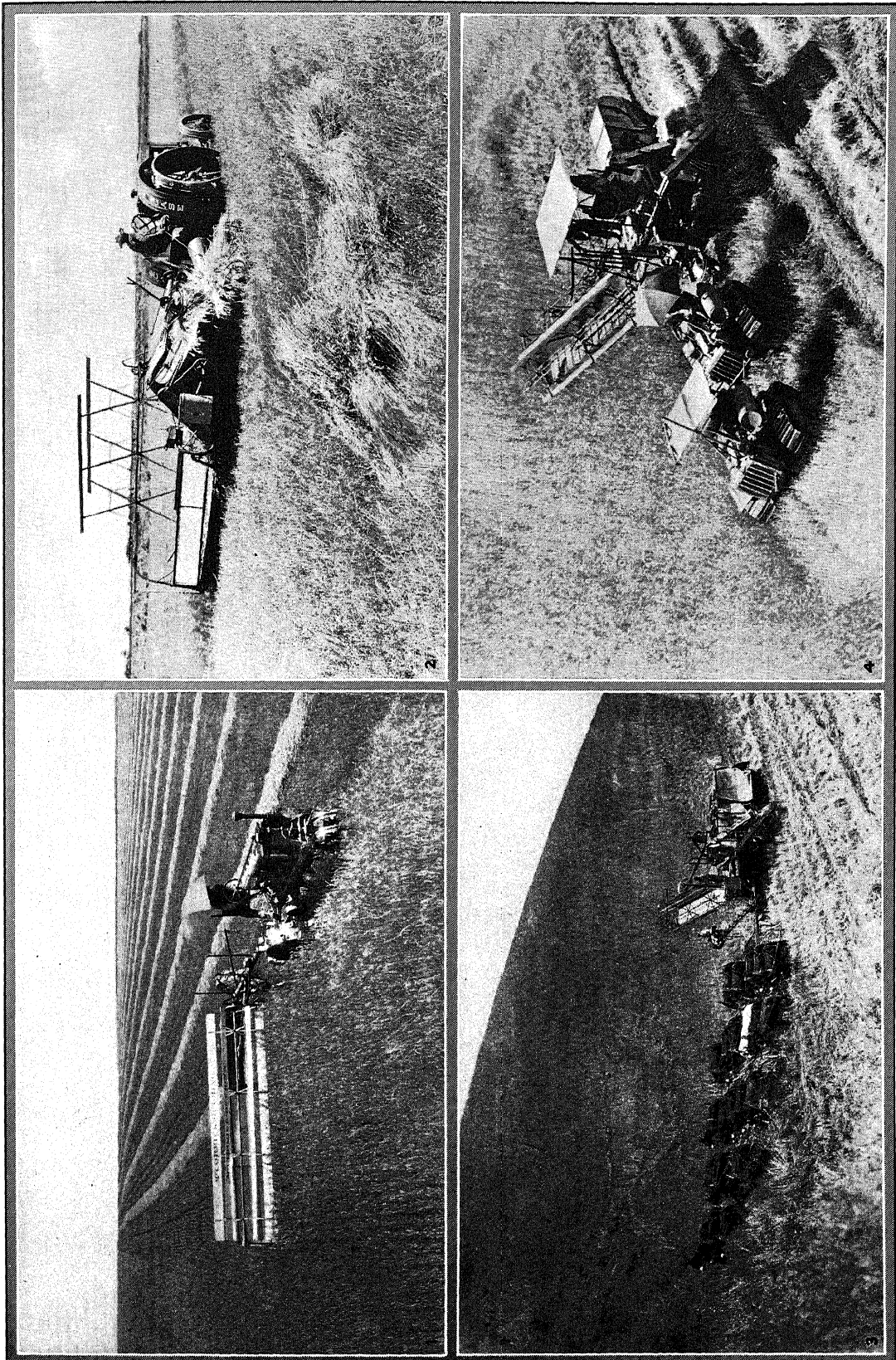
into four types: all-day courses in high schools (113,728 enrolled in 1930); day-unit courses in smaller high schools (9,957); evening courses (60,462), and part-time courses (4,164). The total enrollments in Federally aided agricultural departments in public schools was 981,649. The all-day courses combine vocational subjects such as animal and plant life, farm mechanics and management, rural economics and sociology, home and class projects and supervised practical work with some academic subjects. The evening courses attempt to deal in the main with problems arising out of everyday farm practice. In the agricultural colleges the tendency is to give a minor place to general farming and to train specialists such as research and extension workers, experts in commercial activities related to agriculture, teachers, public servants in public departments, and overseers and managers of specialized and large scale farm enterprises. The total college enrollment in agriculture in 1929-30 was 14,677. The largest field of work is that conducted by the extension services through the three thousand seven hundred and ninety-eight county agents, home demonstration and club workers, assisted by nearly 250,000 voluntary local leaders. The radio has assumed an important place in the extension work of some states.

**Germany and France.** Agricultural education is to-day provided in Germany and France in various courses at different levels, ranging from those based on a completed elementary education to institutions at a university level. As the level advances there is a change in emphasis from the practical up to the theoretical and research stage. Germany has at present 13 academic centers for the study of agriculture, some independent, some associated with universities; below these are higher agricultural schools requiring about six years of secondary education and some practical experience for admission, and preparing overseers, managers and inspectors. At a still lower level are the agricultural trade schools, either full-time, with a two-year course, or winter-schools, conducted through two winter sessions. Less intensive training is given in agricultural part-time continuation schools. Provision is also made for the agricultural and household arts training of women and girls living on farms.

The organization of agricultural education in France is similar with a gradation downward from the *Institut National Agronomique* at the top, through the national schools of agriculture, to the practical schools of agriculture which may be full-time or seasonal, permanent or ambulatory. Opportunities also exist for the training of women engaged in agriculture. Part-time agricultural courses offering lectures, demonstrations, experimental gardens, model nurseries and household management training and conducted locally or through ambulatory schools are beginning to increase in number.

**Great Britain.** Full-time higher courses are provided in England in university departments of agriculture or a few independent colleges like the Royal College of Agriculture at Cirencester. The courses

# AGRICULTURAL MACHINERY



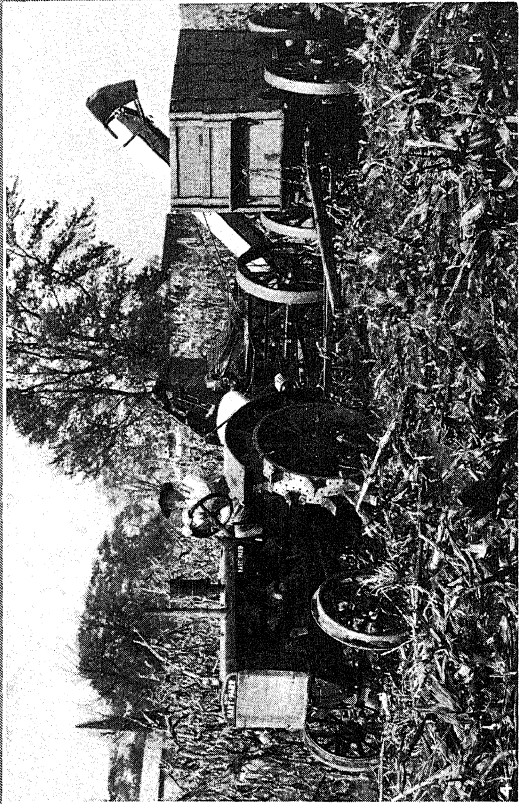
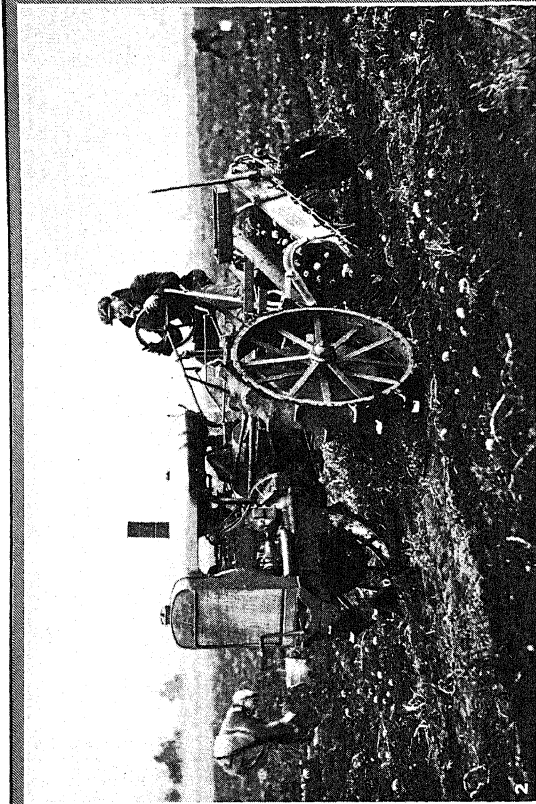
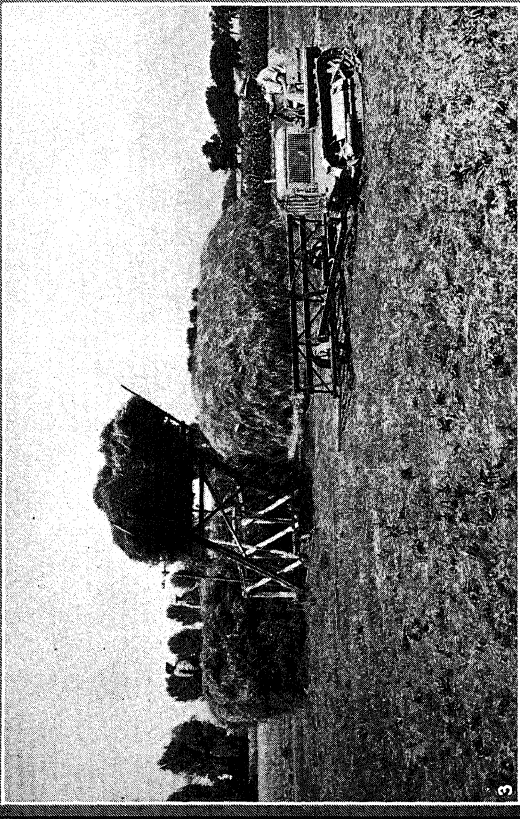
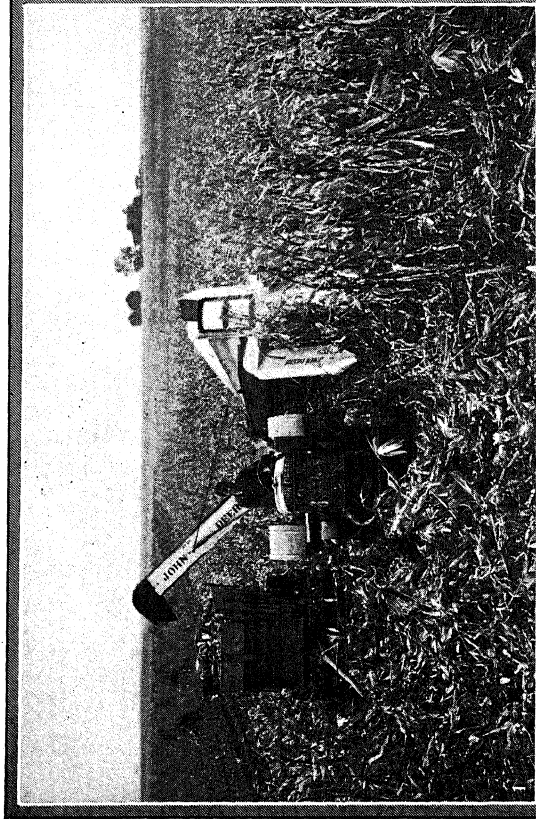
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## HARVESTING ON PRAIRIE AND HILLSIDE

1. The windrow harvester which cuts the grain and leaves it in a windrow on top of the stubble where, after curing, it is picked up by an attachment on the harvester.
2. Power binder cutting grain.
3. Combine-harvester hauled by 24 horses and mules.
4. Harvesting with combine on sloping ground.



# AGRICULTURAL MACHINERY

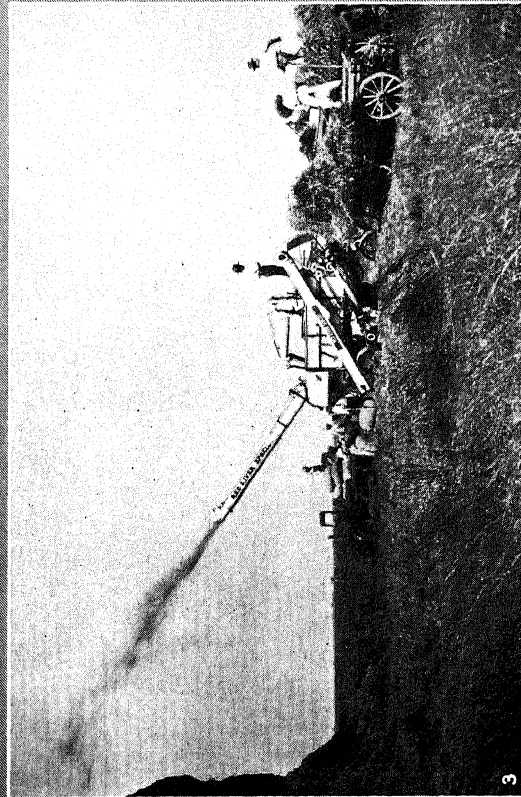
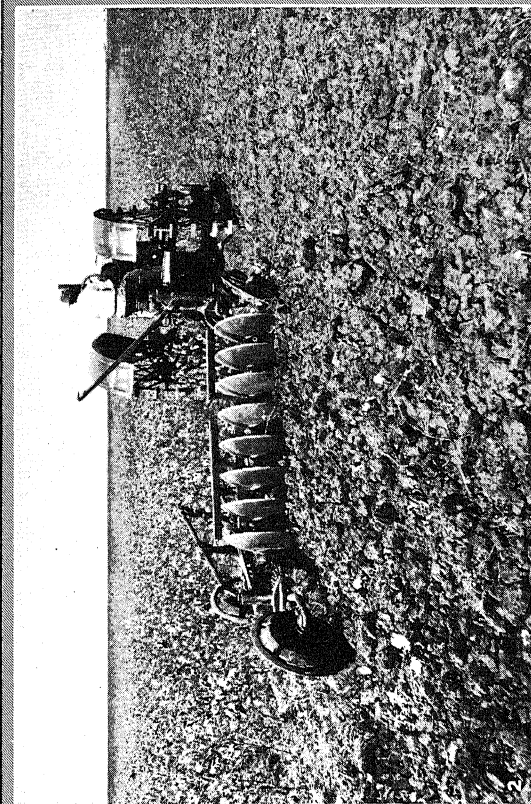
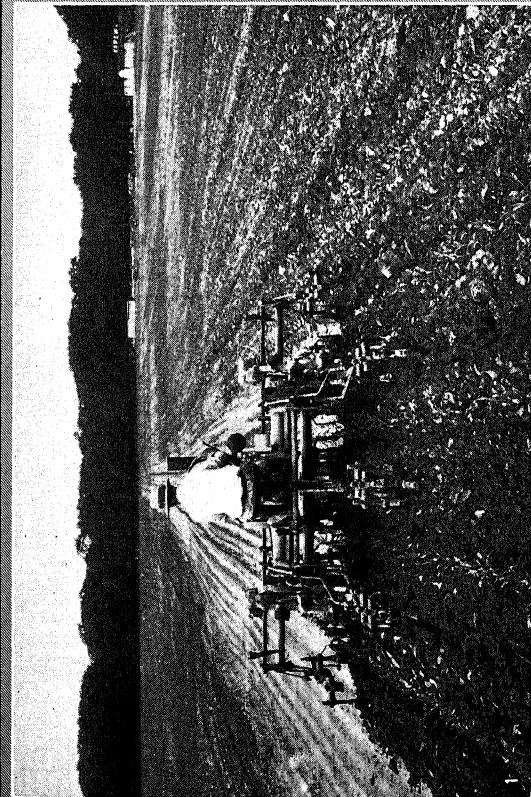


1. COURTESY DEERE AND CO.; 2. ADVANCE-RUMELY THRESHER CO.; 3. CATERPILLAR TRACTOR CO.; 4. OLIVER FARM MACHINERY CO.

## HARVESTING CORN, POTATOES AND HAY BY MACHINERY

1. Two-row corn picker and husker in action.
2. General purpose tractor equipped with two-row potato digger.
3. Harvesting hay into stacks in Colorado.
4. This machine removes the corn from the stalks and husks it.

## AGRICULTURAL MACHINERY



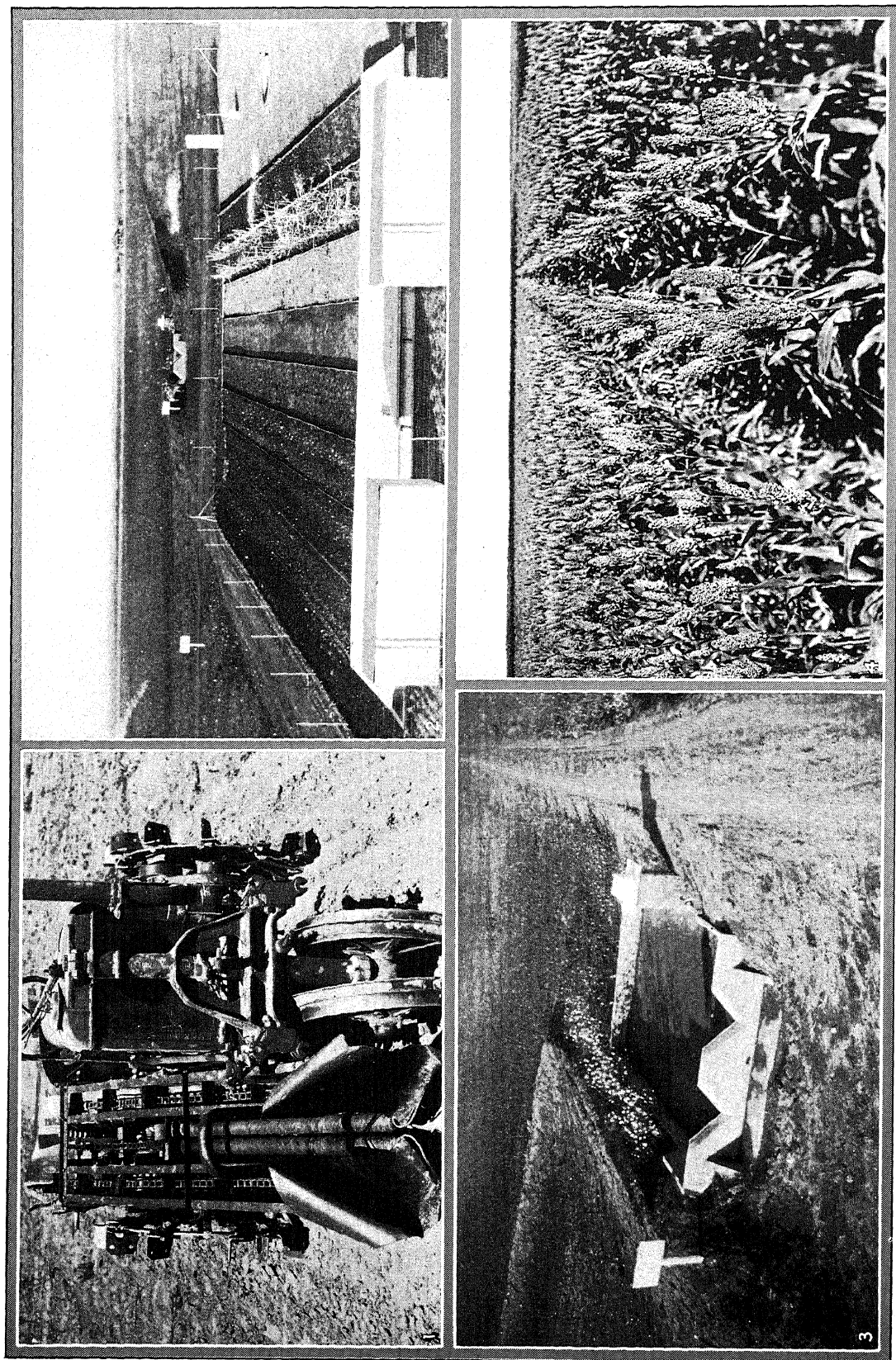
1. 4, COURTESY DEERE & CO.; 2, 3, OLIVER FARM MACHINERY CO.

### SOIL PREPARATION AND CROP PRODUCTION WITH MODERN IMPLEMENTS

1. Four-row tractor cultivator.
2. Row crop tractor pulling one-way plow.
3. Small threshing machine in action.
4. Four-row corn and cotton planter.



## AGRICULTURAL RESEARCH



COURTESY UNITED STATES DEPT. OF AGRICULTURE (TEXAS EXPERIMENT STATION PHOTOS)

### GOVERNMENT AID IN FARM PROBLEMS

1. Stripper which is used in mechanical harvesting of cotton.
2. Miniature control plots for soil and water conservation.
3. Weirs and still pond for measuring soil and water losses from field areas.
4. Field of pure strain corn in Texas.



are from two to three years in length. Farm schools and institutes with short courses both in winter and summer in various branches of agriculture, evening lecture courses, peripatetic instructors, and ambulatory demonstration schools organized by county authorities, reach an increasing clientele. Occasional experiments in providing agricultural courses in secondary schools have been attempted, and a rural bias is being given to the work of rural elementary schools. I. L. K.

**BIBLIOGRAPHY.**—W. H. Shephardson, *Agricultural Education in the United States*, 1929; United States Office of Education, *Bulletin*, 1931, No. 20, *Biennial Survey of Education in the United States, 1928-30*; Committee on Agricultural Education in England and Wales, *Report*, 1908; University of Agriculture and Fisheries Leaflet No. 197, *Agricultural Education in England and Wales*, A. Kuhne, *Handbuch für das Berufs- und Fachschulwesen*, 1929; C. Richard, *L'Enseignement en France*, 1925.

**AGRICULTURAL ENGINEERING**, the application of mechanical principles to the industry of agriculture. It is one of the specialized branches of engineering that has developed in recent years. The agricultural engineer's activities are varied. The major lines of work are those dealing with power and machinery, farm structures, irrigation, drainage, control of soil erosion and land clearing, storage and transportation of perishable and staple crops, refrigeration of farm products and rural electrification. By the introduction of mechanical equipment it has been possible to greatly increase the efficiency of agricultural workers. The introduction of mechanical power in field operations has still further increased this efficiency. By skillful planning of the buildings and their equipment the agricultural engineer has made it possible to secure more favorable housing conditions for animals, better storage conditions for crops and increased efficiency in farming operations. In recent years much effort has been made to bring electric power to the farm, and the agricultural engineer has found that it is possible to use enough electric power to secure quantity rates.

Professional courses in agricultural engineering are now offered in 17 agricultural colleges in the United States and several in Canada. The American Society of Agricultural Engineering, founded in 1906, has fostered the development of the profession. It publishes annual proceedings and the journal, *Agricultural Engineering*. On July 1, 1931, a Bureau of Agricultural Engineering was established in the United States Department of Agriculture. The Institute of Agricultural Engineering, University of Oxford, Great Britain, was established several years previous to that date. In Germany, several institutions maintain departments of agricultural engineering. S. H. M.

**AGRICULTURAL FAIRS.** In continental Europe agricultural fairs are an outgrowth of early religious festivals which became centers for the sale of farm produce. Thus the fairs of Leipzig, Novgorod and the French departments are commercial in character.

In England and America fairs were instituted by societies for the promotion of agriculture and are

therefore intended to be educational. Stock, produce and machinery, are shown and demonstrated in competition for premiums and rewards. The Smithfield Society held the first show in England in 1798. In the United States the Berkshire, Mass., Agricultural Society, sponsored by Elkanah Watson, gave the first county fair in 1811 at Pittsfield. By 1860 every agricultural county held fairs annually. In addition state, district, regional, national, international and special shows are now held. Among the latter the earliest were the Madison Square Garden Poultry Show, 1870, and the Fat Stock Shows at Chicago, 1878. Of the 3,000 fairs held early in North America many are peripatetic although most are permanent. The Ohio State Fair grounds at Columbus cost \$5,000,000; those of the Canadian National Exhibition at Toronto, \$13,000,000.

Since 1900 the educational purpose of the American fair has been threatened by too many entertainment features. Further, the farmer exhibitor has been largely driven from competition by professionals. A movement is afoot to bar all but farmers from contests. O. S. M.

**BIBLIOGRAPHY.**—J. Hamilton, *Agricultural Fair Associations and their Utilization in Agricultural Education and Improvement*.

**AGRICULTURAL MACHINERY AND IMPLEMENTS.** The fundamental principles involved in many of the modern farm implements and machines are the same as those employed many years ago. A great deal of progress has been made, however, in the construction and adaptability of such equipment. Modern farm implements and machinery are made of better material, are stronger, more durable, lighter in weight and will do better work than their predecessors.

The use of mechanical power is responsible for much of the progress which has been made. Tractor-drawn and motor-driven implements and machines are capable of working under heavier load and at greater speed than those operated by work animals. *See also* CROP PROCESSING MACHINERY; HAND TOOLS; POWER IN AGRICULTURE; DAIRY MACHINERY; HARVESTERS; PLANTERS; PLOWS; CULTIVATORS; RAKES; BALERS; HAY FORK; HARROWS; CUTTERS, AGRICULTURAL; ROTARY HOE; ROTARY TILLER. W. M. H.

**AGRICULTURAL PRICES** have been relatively low since 1920. This has led to much discussion concerning the nature of such prices. In general, agricultural production is slower to adjust itself to a raised or lowered price level than is production in most other industries. Farmers cannot modify production materially except at planting season. Farm costs are made up to a large extent of non-cash items such as family labor, use of owned land and the use of equipment and supplies already owned. After a general price decline, production may therefore continue for some years with little abatement because no better use of farm resources can be made than to continue such production.

The demand for most of the staple agricultural

products is less elastic than that for many of the products of other industries. A sudden increase or decrease in production usually affects prices very sharply, since these must drop considerably to bring about CONSUMPTION or export of materially larger quantities, and must rise considerably to bring into balance amounts demanded and amounts available in years of short production. Such effects are less closely related to production in any given country if the product be one like wheat which is largely traded internationally. On the other hand, for such products as potatoes, in the United States, prices rise sharply with short crops and drop to very low levels with large crops.

This inelastic condition both of supply and of demand makes it extremely difficult to adjust agricultural operations to changes in the general price level. Agriculture, therefore, during and after any period of relatively rapid declines in the general price level tends to continue in a depressed condition longer than do those industries which can rather quickly shorten up the supplies of their product offered.

In any period of relatively stable general price level, the price of a given farm product, relative to the prices of other things, depends upon the size of the crop and on the nature of the curve of prices offered for given supplies. The estimated effect of under-normal and of over-normal United States crops on the United States prices of several standard crops is shown below. Thus a crop of cotton 20% over normal sells for a price 23.4% under normal.

Percent- age of normal crop	PERCENTAGES OF NORMAL PRICE				
	Cotton	Wheat	Oats	Corn	Potatoes
120 ....	— 23.4	— 8.8	— 21.9	— 19.9	— 38
115 ...	— 18.4	— 6.3	— 16.2	— 14.9	— 30
110 ....	— 12.9	— 4.1	— 10.5	— 10.0	— 21
105 ....	— 6.8	— 2.1	— 5.8	— 5.0	— 11
100 ....	0	0	0	0	0
95 ....	7.6	2.1	5.7	5.0	12
90 ...	16.3	5.4	10.5	10.0	24
85 ...	26.0	14.3	16.2	14.9	42
80 ...	37.2	.	21.9	19.9	..

The most complete and carefully prepared agricultural price series are those published by the Bureau of Agricultural Economics, Washington, D.C.

J. D. B.

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**AGRICULTURAL RESEARCH.** Careful and systematic experimental work in animal and plant breeding and in other agricultural lines has long been conducted by farmers and others interested in special problems of agriculture.

Public agricultural research in the United States has been carried on under both Federal and state stimulus. The United States Department of Agriculture was established in 1862, but studies leading to publications on agricultural subjects had been conducted by the Patent Office during much of the period

beginning 1839. Research work of the Department of Agriculture is now done through the Weather Bureau, Bureau of Animal Industry, Bureau of Dairy Industry, Bureau of Plant Industry, Forest Service, Bureau of Chemistry and Soils, Bureau of Entomology, Bureau of Biological Survey, Bureau of Public Roads, Bureau of Agricultural Economics, Bureau of Home Economics and Bureau of Agricultural Engineering. Scientific research methods are also applied in some of the work of the Plant Quarantine and Control Administration, the Grain Futures Administration and the Food and Drug Administration. The Office of Experiment Stations maintains experiment stations in five outlying territories and represents the Secretary of Agriculture in his relations to both state and territorial stations. The *Journal of Agricultural Research*, the *Experiment Station Record*, the *Weather Review* and *Crops and Markets* are among the periodicals published by the department.

In the 48 states there are 50 agricultural experiment stations established under Federal and state laws. In a number of the larger states, substations are maintained under state laws.

Federal aid to non-Federal agricultural experiment stations is afforded by the Hatch Act, 1887, the Adams Act, 1906, and the Purnell Act, 1925. The first two acts each carry an annual grant of \$15,000 to each state. Increasing attention has been given to studies connected with COST OF PRODUCTION, MARKETING, STANDARDIZATION of products and other economic problems. The annual amount made available to each state under the Purnell Act for these and for the older established lines is \$60,000. On the average, about three times as much support comes from state and local as from Federal sources.

Experiment stations are annually engaged in some 7,000 distinct lines of investigation, over one-half being in field crops, horticulture, and animal husbandry. Other subjects given prominent attention include plant pathology, economic entomology, soils and fertilizers, agricultural economics, agricultural engineering, veterinary science, genetics, home economics, dairying and forestry. The results of experiment station work are disseminated through annual reports, popular and scientific bulletins, and articles in agricultural and other periodicals. *See also* AGRICULTURAL SOCIETIES.

C. L. S.

**AGRICULTURAL SOCIETIES.** Prior to the adoption of the Constitution such societies were few in the United States. Agricultural fairs in the United States largely followed European, particularly British, models. Many of the fair associations, particularly in early years, were largely supported by persons not primarily engaged in farming. The same applied to many other early organizations for farm improvement. In the case of district and state fairs, institutes and other organizations for rural improvement, public funds and public control played a large part.

The earliest organizations by, of and for farmers were in Pennsylvania, 1785, South Carolina, 1785, Maine, 1787, and New York, 1791. Of these the

Kennebec Society of Maine was the nearest to a strictly farmer organization. It followed the discussion plan and at first held no fairs. State and local organizations were begun in Indiana in 1842, and in Illinois and Wisconsin in 1851. Horticultural interests were prominent in these early societies of the Middle West.

National farm organizations for specialized purposes have long been numerous in the United States. Among general-purpose farm organizations attaining national prominence prior to their complete or virtual disappearance are the Agricultural Wheel, and the Farmers' Alliance, which were started in the '80's and emphasized political objectives. The oldest existing national general-service farm organization, the National Grange of Patrons of Husbandry, was foreshadowed by the formation of its first local unit in 1867. Other rather old organizations are the Order of Gleaners and the Society of Equity.

The triad of national general farm organizations having outstanding importance includes also the Farmers' Educational and Cooperative Union of America, organized in 1902, and the American Farm Bureau Federation, organized in 1913. *See also* GRANGERS.

C. L. S.

**AGRICULTURAL STORAGE.** Tobacco is stored in barns of three general types: tall structures with numerous side and roof ventilators, for air curing; fairly tall tight barns which permit of fires under the tobacco, for open fire curing; and smaller, tightly built barns, heated by outside furnaces, for flue curing. All types have beams arranged to support sticks four ft. long upon which six to ten plants are hung.

Hay is stored in stacks which are frequently capped with a tarpaulin or boards. Shelters for hay vary from a roof supported on poles and without sides to mows in stock barns and special sheds. *See also* GRANARIES; BARNs.

T. A. H. M.

**AGRICULTURE** literally means the tilling of fields. By extension it embraces all occupations based on the productiveness of land. Its ramifications, therefore, extend beyond the mere growing of crops and the rearing of animals to the manufacture of commodities from both animals and crops, such as butter, cheese, casein and sugar from milk; meat, leather, fur, soap and fertilizers from animals; wax from honey; albumen from eggs; meal from grain; vinegar, wine and argol from grapes; cloth, felt and carpets from cotton and wool; rope from hemp and sisal; canned goods from meats, vegetables and fruits. All these and many other articles, although still made to some extent on farms, have developed into distinct industries wholly or partly removed from the farm.

As branches of agriculture, we have **FORESTRY** for the production of timber, lumber and wood pulp and the conservation of water supplies; **HORTICULTURE** for the production of fruits, vegetables and ornamental plants; and **ANIMAL INDUSTRY** for the rearing of livestock, poultry, bees and fish. Each of these may be divided and subdivided into more and more specialized lines so that the term agriculture is popularly restricted to the limited number of crops and animals

still placed under the heading of general farming or mixed husbandry.

Naturally the characteristics of this occupation vary with the region, the soil, the climate and the available market; for instance, in the Southern States though the domestic animals are the same as in the North, many of the crops are different. Climatic differences make it difficult or impossible to grow apples, pears, cherries, currants, and raspberries there and in the North oranges, loquats, figs, dates and guavas cannot be grown. Similarly various plants are sometimes classed as agricultural, sometimes as horticultural crops. For instance, peas and beans, when grown in home gardens for their immature seeds or pods, are horticultural but on a field scale, for commercial canning or for their dry seeds, are agricultural. Such distinctions being of modern application do not fit the present sketch which is limited mainly to the historical development of agriculture and references to the principal crops, animals, processes and branches of the general subject.

In prehistoric time when man depended upon nature for his food it is surmised that his first attempts at agriculture were the capture and domestication of certain animals. His nomadic habits naturally prevented the cultivation of crops. As his flocks and herds increased, however, he was forced to provide for them, so by practices still followed by aboriginal tribes he removed undesired plants to give desired ones a better chance to develop. The destruction of undesired plants by primitive wooden tools was followed by the sowing of the seeds of desired ones. Doubtless at first the tools were operated by women and oxen as they still are not only among savages but in some civilized parts of the Old World.

Egypt supplies our best and most comprehensive records of ancient agriculture. Inscriptions on monuments and tombs carry us back about 5,000 years. These show that several animals had been domesticated; that certain crops were being grown; that tillage and irrigation were commonly practiced; that cattle, sheep, goats and hogs were raised in large numbers and certain ones used for tilling the land. Both cows and bulls were employed as beasts of burden but only the latter were killed for food. Sheep were apparently not used for food but were raised for wool and milk, the latter being largely used to make cheese. Goats, however, supplied most of the milk of those times. Hogs were considered unclean and though raised in large numbers were eaten only by the priests and on specified feast days. Camels and asses were the principal pack animals, the former probably being the first to be domesticated. Horses are not known to have been in Egypt prior to about 1900 B.C. when the country was conquered by the Shepherd Kings of Asia. The stallions were kept in stables, fed on barley and straw and used in war, not for tillage of the soil. Geese and some other water birds were largely raised.

Wheat, barley, durra and millet were sown broadcast on the annual alluvial deposit of the Nile and

irrigated when necessary by methods still in use. Usually one man held the primitive plow while another guided an ox or oxen hitched to it by their horns or shoulders. Wooden hoes of various forms, harrows and rollers were in use but the cereals were harvested by hand and threshed by oxen or asses driven over them on earthen threshing floors in the fields. After winnowing by the wind the grain was generally stored in earthen granaries. Other field crops included lupines, lentils, horse beans, vetches, chick peas and flax, the last named being used for clothing and mummy wrappings. Among vegetables were onions, garlic, leeks and radishes. Fruits included dates, grapes, figs, olives, watermelons and pomegranates.

In Palestine the Hebrews adapted and modified the methods learned during their Egyptian bondage to meet the different climatic conditions. Instead of an overflowing Nile they were forced to depend upon rainfall which at certain seasons ceased altogether. Prior to their enslavement they were great herders of cattle and sheep. In Palestine they returned to these branches of agriculture but also developed crop growing. On the lowlands they produced excellent cereals, especially wheat and barley; on the hillsides were terraces planted with grapes, olives and other fruits; in the valleys were the herds and flocks. During the dry summer millet was grown in areas capable of irrigation.

Greece has left little record of her agriculture which extends from 1000 B.C. to the Roman conquest in 146 B.C. It is known, however, that she added mules to the list of animals already mentioned; that during the winters her livestock was housed; and that bees were largely maintained for their honey and wax. The leading crops were wheat, barley, flax and hemp and the fruits of Egypt, except dates. To these were added apples, quinces, pears, cherries, plums and almonds. The vegetable list was also more extensive, being enhanced by plants native to cool climates, notably beets, cabbage, lettuce, turnips, peas, chicory, and kidney beans. Although methods of culture were still primitive, it is said that the use of manure for the improvement of crop growth is first mentioned in Greek literature.

Roman literature is full of records concerning agriculture. The Romans not only devoted special attention to farming at home but carried their practices to other countries where their methods soon supplanted, dominated or modified the local customs. Moreover, their system of land tenure was an advance over those previously in vogue. As Rome grew by conquest from a small colony to an empire it divided the land in allotments of varying sizes among citizens both of the poorer and the wealthier classes, but also maintained large areas of public land, either for grazing or tillage, under the stipulation that tenants pay a tithe of the produce of cereal lands, two-tenths of fruit and a variable but specified rate for pasture. At all times the state owned the land which it could retake or sell; nevertheless the tenants held possession until the state resumed possession. One result of

this practice was that certain families held their ancestral acres so long that they could not be dispossessed. Another result is that land cultivators became grouped in two classes; the wealthy tenants of the state and the small owners, a division which led to strife between the two. Concerning the agriculture of that period Pliny, Varro, Columella and especially Cato the censor wrote in detail.

All kinds of livestock mentioned above were raised in the Roman Empire but more attention was devoted to breeding than ever before. Mules and oxen were largely used as beasts of burden and castration was commonly practiced. Sheep and goats supplied most of the milk from which large quantities of cheese were made. Hens, ducks, geese, pigeons, peacocks, swans, hare and fish were extensively raised. The most important crops were wheat, barley, millet, oats, rye, alfalfa, vetch, chick peas, hemp, flax, beans, lupines and turnips. In addition to the fruits and vegetables so far mentioned the Romans grew melons, apricots, peaches and celery. Their agricultural practices included careful preparation of the land, drainage, crop rotation, irrigation, manuring and the use of better plows, harrows, hoes and rakes than their predecessors. Harvesting of the cereals was still done by hand with the sickle or pulled and the heads sheared off, and threshed with flails or boards studded with flints or iron spikes drawn back and forth over them.

With the fall of the Roman Empire came deterioration of Roman agriculture because the victorious nations were still in the pastoral stage of development. During the Dark Ages, however, the Saracens in Spain introduced new crops mainly from Asia and Africa, among them sugar, cotton, rice and grapes. The Church in other countries adopted Roman practices which soon wrought great improvement of their lands and crops.

Toward the close of the Middle Ages the Low Countries were as noted for their crops as their manufactured products. Green manuring, much as followed to-day, became a popular method of improving lands and crops and Holland developed the dairy industry for which it is still famous.

During the 13th and 14th centuries the Po River plain of northern Italy, took leading rank because of its grain and garden crop production. In England during these centuries agriculture ranged between feverish activity and inertia. During this period also serfdom in England passed out and tenancy replaced it. As a result, "between 1389 and 1444," according to Prothero, "the wages of agricultural laborers doubled; sumptuary laws against extravagance of dress and diet attest their prosperity."

Progress from the close of the 15th to the 19th century was marked in England by the introduction of hops, potatoes, turnips and red clover and the combination of these last three in rotation with various grasses and cereals. The most notable of these rotations was the Norfolk system introduced by Lord Townsend. It is still largely practiced; namely, wheat,

turnips, barley, clover and grass together followed by cattle-grazing. As part of the system sheep and cattle were fattened for market on turnips and by it farm lands were improved so greatly that rentals could be increased three to five-fold. Many fortunes were made in farming.

In 1731 Jethro Tull published his *Horse-hoeing Husbandry* as the result of experiments in the growing of crops with the spaces between kept cultivated. He invented the seed-drill to do the sowing and the horse-hoe, since modified in many ways and renamed the cultivator. Though he failed to get large crops his principle has been proved correct and is now the basis of success with all intertilled crops.

Until about 1850 the only principle of animal breeding had been "breed from the best, for like produces like," but this rule had not been consistently applied because of varying standards of excellence and cross breeding. Then in England came Robert Bakewell who based a new system of breeding on careful selection of a definite variety or breed and close breeding to fix definite desirable qualities. Hitherto different breeds had been crossed in the hope of improvement. Bakewell acted upon the conclusion that the rule "like begets like" applies as much to the minute details of the animal as to the external characteristics; so he not only molded his animals at will but laid the foundation for modern animal breeding. In North America the early colonists met many difficulties of soil and climate but there were compensations. In Virginia they found TOBACCO and corn, the former at one time used as a medium of exchange, even for wives! In New England exotic grains were grown, but corn manured with fish was the main staple. Cattle and sheep, which were scarce and multiplied slowly, at first foraged on native grasses and were fed timothy hay. Potatoes became prominent early in the 18th century. Despite the more favorable climate of the South, progress was slower than in the North. Everywhere small barns, crude implements and carts rather than wagons prevailed, hoes were more popular than plows and threshing was done as in ancient times by driving animals across the cut grain. Crops were usually grown in the South regardless of rotation and manure was generally wasted.

During the 19th century greater progress was made in agriculture than in all previous time. Principal causes for this were the application of science; the development of railways and steamboats; the settling of vast new lands in Australia, Africa and both Americas; the abolition of slavery; the invention of labor-saving machines; the establishment of government and state institutions for experiment and instruction; the founding of farmers' associations for mutual benefit; the specialization of agricultural industries; organization, distribution and use of agricultural products on business principles; and the publication of information through periodicals, books, public documents and farmers' meetings.

Largely due to government sponsorship, chemistry,

physics and biology, working separately or in concert, have solved countless problems in soil physics, the invention and improvement of agricultural tools and machines, plants and animal nutrition and breeding, pest control. They have been instrumental in the development of such industries as dairying, cane and beet sugar production, fiber crop improvement, the fertilizer and canning industries and in countless other directions. Thus these sciences have lifted agriculture from the realm of rule-of-thumb to the dignity of a multi-branched art and given it a spokesman in the cabinets of nearly all civilized nations.

The U.S. Department of Agriculture began in 1839 when Congress appropriated \$1,000 "to be taken from the Patent Office fund for the purpose of collecting and distributing seeds, prosecuting agricultural investigations and procuring agricultural statistics." In 1862 it was established as a distinct branch of the government with a Commissioner of agriculture as its head. In 1889 the title was changed to Secretary of Agriculture and the incumbent became a member of the President's cabinet.

The Department as then outlined in the act of its establishment was "to acquire and diffuse among the people of the United States useful information on subjects connected with agriculture . . . to procure, propagate and distribute among the people new and valuable seeds and plants." Since then the scope of the Department has been repeatedly widened until it is now one of the world's greatest scientific institutions.

Almost coincident with the development of the national Department came the founding of state departments, farm colleges and schools, of which the Michigan Agricultural (now State) College founded in 1857 was the first. Though agricultural investigations had been conducted at Yale University and in several state agricultural colleges prior to the passing of the Hatch Act of 1887, each state was then authorized to establish one or more experiment stations. Now almost every state has at least one college and station.

With the developments of science and the dissemination of information since about 1850 have come the invention of machines and the application of power to farm operation. Improved plows, harrows, seeders, cultivators, mowers, reapers, binders and threshers have reached their climax in headers and combines. Similar inventions for planting, cultivating, spraying, digging and sorting potatoes are operated in a big way. Nursery stock is now largely dug by machinery. Poultry is hatched by incubators and reared in batteries. Cows are milked by machines and their value determined by the Babcock test. (See CATTLE RAISING.) Orchards are cultivated by wide-spreading harrows, sprayed or dusted by power machines and the fruit graded and cleaned mechanically. Many kinds of vegetables are similarly handled. Plants of sweet potatoes, tobacco, tomato and other crops are planted by machines, either hand or power-operated. Grass and clover are seeded, mowed for hay, tedded, raked, loaded, stacked or stored in barns by machinery. Corn

is sown in drills or check rows, cultivated several rows at a time, harvested, eared, husked, shelled and the stover shredded and stored or the green stalks cut and blown by power driven devices into silos for stock food. Cotton is picked by machines.

During the early years of this period the machines were operated by horses and mules. These were being supplanted toward the close of the 19th century by steam engines which in turn gave way to gasoline driven tractors. Tractors are now powerful enough to plow many furrows, harrow them, and sow the seed all at one operation or at harvest to reap, thresh, clean and sack wheat at one passage across the field. Even the airplane has been requisitioned, its function being to protect extensive cotton fields, orchards and forests against insect enemies by scattering poison dusts at critical times.

Other developments have profoundly aided agriculture. For instance, ice making and cold storage have been applied to warehouses, steamships and railways; locomotives and freight cars have been increased in capacity; the air-brake has been applied to all freight trains, so perishable products are now quickly delivered and safely stored. Because of the air-brake it is possible to carry on truck farming in favorable areas from Virginia southward and westward to California, often 500 to 3,000 or more miles from the final markets. More recently the motor truck has aided the extension of market gardening and fruit growing comparatively near cities, thus permitting products to reach consumers properly developed and in fresh condition.

Dehydration, evaporation and canning have broadened the market for fruits, vegetables and meats. Sizing and grading have largely standardized fruit in the market and the manufacture of cull fruit into juices, jams and jellies has reduced losses from such wastes.

The development of great packing establishments has made possible the use of every part of the animal body—meat for food, fat for soap, hide for leather, hair for brushes, entrails, blood, bones and horns for fertilizer and the droppings, dried, ground and deodorized, for commercial manures. As a result the prices paid stockmen have become higher and more stable.

Coincident with these developments has been the adoption of cooperative methods. Cooperative creameries handle milk in the making of butter and cheese in such economical ways as to utilize the skimmed milk and the whey for the manufacture of by-products. Fruit and vegetable growers have also formed cooperative associations which have benefited them in the disposal of their products and the stabilization of prices.

It is evident that agriculture has become a highly specialized, widely ramified series of occupations based upon direct or indirect products of the soil, enhanced by the contributions of science, stabilized by the demands of life and made profitable by modern business methods.

M. G. K.

**AGRICULTURE, DEPARTMENT OF**, a department in the United States Government established in 1862. Since its establishment it has expanded rapidly and today employs a personnel of about 22,000 men and expends more than \$150,000,000 annually. Of this amount, however, two-thirds are devoted to subsidizing state research and extension work, the construction of roads and the furtherance of conservation policies. The work of the department proper falls into five categories: research, extension activities, the eradication or control of plant and animal diseases, the maintenance of a variety of services such as market news, weather forecasting and law enforcement. The enforcement of the Food and Drug Acts, and the Meat Inspection Law, are examples of this last activity. The Department is headed by the Secretary of Agriculture, who has been a member of the President's CABINET since 1889, and five directors in charge of scientific work, regulatory work, extension, information and business administration respectively.

S. C. W.

**AGRIGENTUM**, an ancient town on the south coast of Sicily, founded by a Doric colony from Gela about 582 B.C. It was a wealthy and flourishing city, being ruled by tyrants until destroyed by the Carthaginians in 405 B.C. Timoleon rebuilt it in 338 B.C., bringing colonists from Velia, in Lucania. By 210 B.C. it had come under Roman rule. There are remains of fine Roman temples as well as Greek tombs. The modern city of Agrigento, also known as Girgenti, is on the site. It trades in sulphur, grain, olive oil and almonds. A museum and a cathedral founded in the 14th century are located here. Pop. 1931, 30,932.

**AGRIMONY** (*Agrimonia*), a group of perennial herbs of the rose family, found in fields and waysides widely throughout the north temperate regions. The common agrimony (*A. Eupatoria*) of Europe is represented in the United States and Canada by several closely related forms. All are bitter, slightly aromatic plants with astringent root stocks that yield a yellow dye. They bear much divided leaves, with smaller leaflets interspersed between larger ones, and narrow clusters of small yellow flowers. The fruit, which is bristly with hooked hairs, readily clings to the fur of animals or to clothing.

**AGRONOMY**, a division of AGRICULTURE, restricted in America to a study of crop production and mostly carried on by state and governmental agencies. The science includes experimental work on crop plants, their yield, diseases, and, especially, their suitability for various environments. It also deals with such fundamental factors of crop production as climate, soils and the management of crop lands.

**AGUASCALIENTES**, one of the smallest states of Mexico, situated on the great central plateau of the country, with an area of 2,969 sq. mi., and a mean altitude of 6,000 ft. above sea level. Because of the high altitude, the climate is cool and very healthful. The western part of the state is traversed by mountains, sloping to wide fertile plains in the eastern part.



The state is noted for its fine mineral springs, and has some important copper and silver mines. Many kinds of fruit and vegetables are produced, and about 40 varieties of melons are grown for export to the United States. The capital of the state is Aguascalientes, and other cities are Gallardo, San Gil, Chicalote. Pop. 1921, 107,581; 1930, 132,492.

**AGUASCALIENTES**, a city of Mexico, and capital of the state of the same name, situated in the southern part of the state, about 365 mi. northwest of Mexico City at an elevation of about 6,000 ft. above sea level. It is the industrial center of an extensive plateau that stretches over most of the state, and has railway shops, cotton and tobacco factories, smelting works, tanneries, distilleries, and is especially famous for its unique pottery and exquisite hand-drawn work on linen. The city has street railways, an electric light plant, public buildings, hospitals, modern hotels and schools, libraries, a market place, and some interesting old churches.

Near Aguascalientes are numerous hot springs, from which its name is derived. It is also called The Perforated City, from a system of tunnels which form a network beneath it, the work of some prehistoric tribe. These have never been fully explored. The town was founded in 1522, made a city in 1824, and became the capital of the state 11 years later. Pop. 1921, 48,041; 1930, 81,612.

**AGUE.** See MALARIA; TROPICAL DISEASES.

**AGUILAR, GRACE** (1816-47), English Jewish poetess, religious writer, and novelist, was born at London in June 1816. Throughout her entire short life she struggled against ill-health and constitutional weakness, a handicap under which all her works were written and which led to her death at Frankfort-on-Main, Sept. 16, 1847. Her first poetical collection, *The Magic Wreath*, was published anonymously in 1835, when she was barely 19 years old. Subsequently she distinguished herself as a novelist and historical writer, using as her favorite subject the life of the Marranos, or secret Jews of Spain and Portugal, from whom the Aguilar family was descended. Her most popular work in this field was *The Vale of Cedars*, 1850. Other important works of hers were: *The Spirit of Judaism*, 1842; *The Jewish Faith*; *The Women of Israel*, a group of historical portraits gleaned from the books of the Bible and of the Apocrypha; *The Days of Bruce*, 1852, a Scottish historical romance. It would seem that her purpose in writing her religious books was that of furnishing the Jewish women of England with material and knowledge wherewith to combat those who were trying to convert them to Christianity.

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**AGUILAS**, a city of Spain in the province of Murcia, situated at the foot of a crag jutting into the Mediterranean. It has a fort, foundries, two harbors, and exports considerable lead-containing silver, as well as iron ore, sulphur, esparto grass and figs. Est. pop. 1929, 17,000.

**AGUINALDO, EMILIO** (1870- ), Filipino general, was born at Imus, Luzon, in 1870 of Chinese and Tagalog parents. He attended Saint Thomas University, Manila, and entered politics. In 1896 he led an unsuccessful uprising against Spain and was then paid by Spain to go into exile at Hongkong. He returned during the Spanish-American War to take part against the Spaniards. With American help he set up a provisional government but when the Islands were refused independence in 1899 led an insurrection against the United States in the hope of establishing an independent Philippine republic. He was captured by General Funston in 1901. He acknowledged the authority of the United States and was allowed to retire to private life.

**AHAB**, a king of Israel who reigned 22 years, 896-874 B.C., being of the dynasty of Omri (II Kings 16-22). In Samaria he added "an ivory house" to his palace and built cities, but his undoubted abilities in peace and war were overshadowed by his marriage with Jezebel, daughter of Ethbaal, king of the Sidonians, under whose influence he set up the worship of Baal and came into conflict with Elijah. In insolent terms Benhadad, King of Syria, demanded submission. Ahab, revealing supreme courage, made the immortal answer, "Let not him that girdeth on his armor boast himself as he that putteth it off." Benhadad, "drinking himself drunk," was annihilated in battle but according to the prophets Ahab, in making a covenant with this enemy, threw away the fruits of victory. Ahab and Jehoshaphat, king of Judah, then fought as allies against Syria and Ahab, warned of coming death, exchanged costumes with Jehoshaphat. But a soldier "drew a bow at a venture" and smote Ahab between the joints of his armor. Brought to Samaria, the chariot was washed and according to prediction, dogs licked up the royal blood.

**AHANTSAYUK**, an Indian tribe speaking a dialect of the Kalapooian stock, living on and near the Pudding River in Oregon.

**AHASUERUS**, the Persian king who appears so prominently in the story of Esther. See also Nehemiah 4:6. Probably he may be identified as Xerxes. In Daniel 9:1, the name is attributed to the father of Darius the Mede.

**AHAZ**, eleventh king of Judah, 742-728 B.C., attacked by Pekin, King of Israel, and Rezin, King of Syria, was met by Isaiah and told not to be "faint-hearted for the two tails of these smoking firebrands." This was the occasion when, as a sign, there was uttered the famous prophecy of a virgin who should bear a son and "call his name Immanuel." The attack on JERUSALEM failed, but Judah lost the valuable seaport of Elath on the Red Sea. Ahaz (II Kings 16) sought the assistance of Tiglath-Pileser, King of Assyria, to whom he sent treasures from the temple and his palace. Rezin was slain and Damascus was captured, events mentioned in Assyrian inscriptions, but for Judah a disastrous alliance was accompanied by a headlong plunge into the "abomination" of idolatry, including the sacrifice of the king's own son by



fire to Molech. Hosea and Micah were the prophets of the period and the son of Ahaz was the reformer, Hezekiah.

**AHAZIAH**, a name borne by the eighth king of Israel, the son of Ahab and Jezebel, and also by the fifth king of Judah, whose mother, Athaliah, was the daughter of Jezebel (861). The story is told under the heading of JEHU.

**AHITHOPHEL**, a wise councilor of David and a supporter of Absalom. Comparison of II Samuel 11:3 with II Samuel 23:34, suggests the interesting probability that Ahithophel, whose counsel was "as if a man had inquired at the oracle of God," was the grandfather of Bath-sheba, and therefore the great-grandfather of Solomon, the embodiment of such wisdom.

**AHMED**, the name of three Ottoman Sultans. Ahmed I (1589-1617), was born at Magnesia, Asia Minor, in 1589. In 1603 he succeeded his father Mohammed III, and waged unsuccessful war against Austria though still retaining Hungary until 1606. He built the Mosque named for him at Constantinople. He died Nov. 22, 1617.

Ahmed II (1642-95), born in 1642, succeeded his brother Suleiman III. He was assassinated by the Janissaries Feb. 6, 1695.

Ahmed III (1673-1736), born in 1673, succeeded his deposed brother Mustafa II in 1703. He reconquered the Morea from Venice in 1715, but lost the Banat and northern Serbia to Austria. Charles XII of Sweden received refuge at his court from 1709 to 1714. He died in 1736.

**AHRIMAN**, the Zoroastrian God of Evil, twin brother and eternal opponent of Ahura Mazda (Ormazd) the god of light and good. The history of the universe and the life of man in the older Zoroastrian faith, i.e., pre-Sassanid, was a battle between Ahriman and Ahura Mazda to be terminated only with the victory of Ahura Mazda at the Last Judgment, set somewhere about 2000-2500 A.D. The duty of man was to live righteously so that his life would aid Ahura Mazda in his struggle against Ahriman. The only existing Zoroastrians, the Parsis of India, are strict monotheists, refusing to recognize the existence of Ahriman.

**AHTENA**, an Athapascan Indian tribe, consisting of six divisions, with permanent villages in the valley of the Copper River in Alaska. Their culture is simple and includes some elements of the Northwest Coast Indian culture complex, such as the keeping of slaves. They are hunters and fishermen and are principally known as the trading intermediaries between the coastal and interior tribes of the region.

**AHURA MAZDA**, later Ormazd, the Wise Lord, is the name of God in the religion of ZOROASTER, or Zarathustra (7th century, B.C.). The Zoroastrian religion of ancient Persia, or Iran, is represented to-day by about 10,000 Gabars of southeastern Persia and 90,000 Parsis of western India. To Zoroaster Ahura Mazda was preeminently the One God, strong and holy, the altogether righteous and the all-creator. Be-

fore the time of Zoroaster, he was worshiped by the Iranians as one of many deities. The prophet, however, gave himself to a vigorous reformation of religion and morals, and elevated Ahura Mazda to the place of sole supremacy, interpreted as spirit only—the spirit of truth, purity and justice. By this elevation of Ahura Mazda, Zoroaster made religion both ethical and spiritual. Zoroaster was a "monotheist of the strictest type."

After Zoroaster there developed in his religion a dualism of good and evil, represented by Ormazd on the one hand, and Ahriman on the other. Zoroaster had recognized evil, not as something to explain, but as something to overcome by Ahura Mazda's aid. He warned against evil mind, *angra mainyu*, and the lie, *druj*, as enemies of the Wise Lord. In time Zoroastrians, following their prophet's lead, personified evil as Ahriman, the Devil who was in constant strife against God. It became man's duty, therefore, to ally himself with God and thus in the end to compass the defeat of Ahriman. There developed, also, after the prophet's time a host of angels, or ministers of Ormazd, who had been to Zoroaster merely qualities, *amesha spentas*, of Ahura Mazda, such as good mind, order, devotion, welfare and immortality. These angels fought with good men, therefore, against the powers of evil.

In the view of all Zoroastrians, of whatever time, Ahura Mazda will ultimately prevail, and what he commands, namely, good thoughts, good words and good deeds, will be vindicated and rewarded. Ahura Mazda will save all who depend upon him alone.

J. C. A.

**AI**, a three-toed SLOTH.

**AÏDA**, an opera in four acts by GIUSEPPE VERDI, libretto by Mariette Bey, done into Italian verse by Antonio Ghislanzoni after the French story by Camille du Locle; première, Cairo, 1871, Milan, 1872, New York, 1873, Paris and London, 1876. Created in the composer's 58th year it represents the full maturity of his genius, being equalled only by its successors *Otello* and *Falstaff*. Save for *Il Trovatore* it is the most universally popular of all his operas. A richly scored musical setting is supported by the sumptuous languors and splendors of its Egyptian scene.

Seeking to subdue the Ethiopians who, despite previous defeat, are again on the verge of invading Egypt, the king of Egypt takes counsel of the goddess Isis. She appoints Rhadames, a youthful Egyptian warrior, to lead the king's army to certain victory. Aïda, daughter of the Ethiopian king Amonasro, has already been taken captive and made a slave to the Egyptian princess Amneris, and Rhadames, ignorant of her noble rank, hopes to marry her, being overpowered by her loveliness which he proclaims in the celebrated aria "Celeste Aïda." He little reckons with the vengeance of Amneris, however, whose jealous fury breaks forth upon discovering that Rhadames is in love with her slave-girl, instead of with herself—a double outrage since the Egyptian king had already offered Amneris in marriage to Rhadames in token of

his valor on the field of battle. Meanwhile, Amonasro, the Ethiopian king, has been captured; and he now connives with his daughter Aïda to extract important military information from her lover. But a clandestine meeting between Aïda and Rhadames is discovered by the jilted princess Amneris whose jealous fury again flares. Condemned by a court of priests to be imprisoned in a vault beneath the Temple of Isis, Rhadames dies at last in the arms of Aïda who has chosen to die with him rather than live without him.

**AIDYN** or **AÏDIN**, a city of Turkey in Asia Minor, capital of the vilayet of Aidyn. It is situated on the Meander River, about 55 mi. by rail southeast of Smyrna. The city has many Greek churches and spacious bazaars. In the neighborhood are the ruins of the ancient town of Tralles. In 1899, a severe earthquake shook the district. The Greco-Turkish war in 1919-1922 caused great suffering in Aidyn. The manufacture of candies and leather and trade in cotton and figs constitute the chief industries of Aidyn. Pop. 1927, 70,307.

**AIGUELLETES.** See UNIFORMS, MILITARY AND NAVAL.

**AIGUN**, a port of Manchuria, situated in Heilungkiang province near the border of Siberia. This frontier city of China is situated on the southern bank of the Amur River. Horses, donkeys, cows and pigs are raised in the vicinity and traded in town. Old Aigun was destroyed by the Russians in 1900, but the new city became an open port by the Komura Convention of 1905. The business community that used to live in Aigun now prefers to settle directly opposite Blagovestchensk at Taheiho, called by the Russians Saghalan. Pop. 1928, 41,100.

**AIKEN, CONRAD POTTER** (1889- ), American critic and poet, was born at Savannah, Ga., Aug. 5, 1889. He was graduated from Harvard in 1911. Among his works are *Earth Triumphant*, *The Jig of Forslin*, *The House of Dust* and *The Coming Forth by Day of Osiris Jones*, 1931, all poems; a novel, *Blue Voyage*; and two volumes of short stories, *Bring! Bring!* and *Costumes by Eros*, 1928.

**AIKEN**, a city and the county seat of Aiken Co. in southwestern South Carolina, situated 17 mi. northeast of Augusta, Ga. Bus lines and the Southern Railroad serve the city. Cotton, corn and vegetables are the leading crops of the vicinity. The chief industries are cotton manufacture and kaolin mining. Aiken is a popular winter resort for sportsmen, especially polo players. Thomas Hitchcock, Jr., international polo star, was born in Aiken. The city was founded and incorporated in 1836. Pop. 1920, 4,103; 1930, 6,033.

**AILANTHUS**, a group of trees of the quassia family, the best known of which is the Chinese sumach or tree-of-heaven (*A. glandulosa*). It is a lofty, spreading tree with leaves resembling those of the ash. The small green flowers are borne in large clusters, those of the male tree exhaling an unpleasant odor. A native of China and Japan, it was brought to England in 1751 and since has been planted extensively in gardens and parks in Great

Britain, southern Europe, and North America. It is one of the few shade trees that will thrive in smoky manufacturing districts.

**AILERONS.** See AIRPLANE.

**AINU**, anthropological division. See RACES OF MANKIND: *Other Groups*.

**AINU**, the language spoken by the survivors of the pre-Japanese natives of Japan, now restricted to the northern part of the empire, though once extending at least as far south as Tokio. The word means "man," and the language, which is "agglutinative" (see AGGLUTINATION), constitutes a distinct linguistic family (see FAMILY, LINGUISTIC). The phonetic system is very simple; gender and number are lacking; syntactic relationship is shown by means of particles; and the various aspects (see ASPECT) of the verb are indicated by auxiliaries. The subject stands at the beginning of the sentence, and the verb at the end; the object is placed before the verb and all subordinate clauses precede the principal verb. The method of enumeration is complicated, but both decimal and vigesimal systems exist. There is no script or written literature. J. J. L. D.

**BIBLIOGRAPHY.**—J. Batchelor, *An Ainu-English-Japanese Dictionary* (including an Ainu grammar), 2 vols., 1905.

**AIR**, the material of which the earth's ATMOSPHERE is composed. From the early Greek period until the latter part of the 18th century, air was supposed to be a simple substance, but it is now known to be a mixture of many elements. Air is the familiar type-form of a permanent gas. It is a nonconductor of heat and electricity. Its density is 0.001293 grams per cu. cm., or 0.007608 lbs. per cu. ft., under standard conditions; its specific heat at constant pressure is 0.2375; its ratio of specific heats, 1.41; its coefficient of viscosity, 0.00018. A. A. K.

**AIR BASE, NAVY.** See NAVAL BASES.

**AIR BRAKES.** See BRAKES.

**AIR COMPRESSORS**, machines for delivering large quantities of air into a confined space and thereby increasing its pressure. In a broad sense, air compressors include FANS and blowers, which may be of the rotary or centrifugal types; but, as ordinarily considered, compressors are of the piston type.

Piston air compressors consist, essentially, of a cylinder, a piston and inlet and outlet valves, being basically a reversed EXPANSION ENGINE. In operation, as the piston moves away from the cylinder head, air is drawn through the inlet valve, and as the piston moves toward the cylinder head on the return stroke it compresses the air into a smaller volume at a higher pressure and delivers it through the outlet valve into a receiver (see ACCUMULATORS). Compressors may be double acting, air being compressed on both strokes of the piston, both ends of the cylinder being closed and there being two sets of valves; or they may be multi-stage, where air under small pressures is delivered from one cylinder to a succeeding one of smaller volume, where it is further compressed.

The valves of the air compressor may be of the poppet type, operating under the air pressure, or they

may be actuated positively by a cam arrangement. A special type of plate valve automatically "unloads" the compressor when the air in the receiver reaches a predetermined pressure.

The pistons of a compressor are connected to a source of power through piston rods and a crankshaft, the latter usually being coupled to the crankshaft of a STEAM ENGINE or INTERNAL COMBUSTION ENGINE, though other types of drive may be used. To keep the cylinders of compressors cool they are usually surrounded by water jackets connected to a cooler, and inter-coolers are usually placed between the cylinders of multi-stage compressors.

**AIR CONDITIONING**, the process of controlling some or all of the physical and chemical qualities of air in an enclosed space. It may be applied to a space occupied by people in order to improve their comfort and health; it may be used for its beneficial effects on stored materials and materials in the process of manufacture; or it may be employed for bettering manufacturing processes.

For human comfort and health, complete air conditioning includes controlling the temperature, the moisture content and the motion of the air in accordance with accepted standards; maintaining the air free from objectionable odors, dust, BACTERIA and other injurious substances; and, in some cases, controlling ultra-violet light, OZONE and the ionized state of the atmosphere. The factors usually considered most important are temperature, moisture content and air motion, all of which affect a person's sense of warmth, and each must be controlled in relation to all others. The American Society of Heating and Ventilating Engineers uses as the basis for rating the perfection of atmospheric conditions for human comfort the *air chart* developed by E. Vernon Hill.

Until recently, the application of air conditioning to human comfort was limited to warming the air in winter and producing a slight cooling effect in summer by keeping the air in motion, or by supplying outside air. It is now, however, possible to control not only these but also other factors affecting comfort, including lower temperatures in summer. Such air conditioning is finding increased application in theaters, auditoriums, offices, homes, railway trains, ships and schools.

Temperature, moisture content, and dust content of the air are the factors usually given major consideration in air conditioning for the improvement of materials, manufacturing processes and manufactured products. These are important in the preservation of books, furniture, art treasures and many forms of merchandise on exhibit, in storage or in transit. The manufacture of cigars and other tobacco products, textiles, fine woodwork, candy, macaroni and a multitude of other products can be carried on satisfactorily in only a few peculiar climates or during certain seasons of the year unless air conditioning is employed. The application of air conditioning to these and to an ever widening list of manufacturing processes is growing rapidly.

Equipment for conditioning air includes heaters, mechanical refrigerators or ice, air filters or washers, humidifying and dehumidifying units, and fans. This equipment may be remotely located, the conditioned air being carried by ducts, or it may be compactly arranged in a cabinet within the room in which the air is to be conditioned. See also UNIT AIR CONDITIONING. F. C. H.

**BIBLIOGRAPHY.**—F. C. Houghten, W. W. Teague and W. W. Miller, *Practical Application of Temperature, Humidity and Air Motion Data to Air Conditioning Problems*, Transactions, American Society of Heating & Ventilating Engineers, 1927.

**AIR CONDITIONING METHODS.** Generally the process of air conditioning for comfort consists of passing air through water sprays. The water is cooled by refrigeration, or other means, to the temperature corresponding to the dew point of the humidity required. After passing the sprays, its temperature is raised to comfort conditions, either by heating coils or by mixing with air that has not been cooled. Another method involves the separate control of humidity by the use of moisture-absorbing substances, such as silica-gel or calcium chloride. After dehumidification the air is cooled to the desired temperature by passing it over coils in which cold water is circulated. Although this method decreases the amount of refrigeration required, the saving is approximately compensated for by the cost of the dehumidifying process. See also UNIT AIR CONDITIONING. R. B. PU.

**AIR CORPS.** See MILITARY AVIATION.

**AIRCRAFT CARRIERS**, according to the definition included in the treaty for the limitation and reduction of naval armament signed in London on Apr. 22, 1930 (see LONDON NAVAL PARLEY), include any surface vessel of war, whatever its displacement, designed for the specific and exclusive purpose of carrying aircraft, and so constructed that aircraft can be launched therefrom and landed thereon. Placing a landing-on or flying-off platform on the deck of a CAPITAL SHIP, CRUISER or DESTROYER, not so designed or adapted exclusively, does not cause that vessel to be charged against or classified as an aircraft carrier. An aircraft carrier must not be designed or constructed for carrying a more powerful armament than allowed by the Washington and London Naval treaties. The first aircraft carrier in existence was built by the British in 1914. The largest carriers in 1931 were the U.S.S. *Lexington* and U.S.S. *Saratoga*, built in 1920 and 1921. They are of 33,000 tons displacement and are built from BATTLE CRUISERS changed in design, that were under construction when the Washington Treaty went into effect. The treaty limit on future carriers is 27,000 tons displacement. Later carriers are of the island pattern, and the largest carry 70 to 80 planes. R. E. C.

**AIRCRAFT ENGINE**, an INTERNAL COMBUSTION ENGINE especially designed for propelling aircraft, generally of the four-stroke-cycle type, using gasoline as fuel. A few small two-stroke-cycle engines have been used and several types of Diesel engine (see OIL

ENGINES) are under development, some being in use. The weight of the modern airplane engine varies between 1.5 and 3.0 pounds per horsepower for ordinary service and may be as low as 0.8 pounds per horsepower for racing planes. Aero engines have normal crankshaft speeds of from 1,500 to 2,500 revolutions per minute when the propeller is directly driven, and from 2,000 to 3,000 when the propeller is driven through GEARS AND GEARING. At all working speeds these engines must give good fuel economy to economize on the weight of fuel carried. The modern engine is able to run for long periods at relatively high power output, the average airplane using maximum power when taking-off and 60 to 80% maximum power when cruising.

The following types are in general use at the present time: Vertical, with cylinders arranged vertically, above or below the crankshaft, in a single row; "V," with cylinders arranged in two rows, in the form of the letter "V"; "W," with cylinders arranged in three rows; Inverted, of the vertical, "V" or "W" types with cylinders hung below the crankshaft; and Radial, with stationary cylinders arranged radially around a common crankshaft. Any of the types may be water or air cooled. The radial type and the types having four cylinders or less are generally air cooled, while water-cooled engines are usually built in "V" or "W" forms.

C. F. T.

BIBLIOGRAPHY.—C. H. Chatfield and C. S. Taylor, *The Airplane and Its Engine*, 1928.

**AIRCRAFT ENGINE CONSTRUCTION.** In general, the moving parts of the AIRCRAFT ENGINE such as the crankshaft, connecting rods, valves, GEARS AND GEARING and auxiliary drive mechanisms are made from alloy steel forgings, machined all over. Chrome-nickel or chrome-vanadium steel (see CHROMIUM STEEL) is usually used for such parts, the carbon content being varied to suit the hardness and strength requirements. All steel parts are suitably heat treated. See HEAT TREATING. The enclosing parts such as the crankcase, cylinder heads and the housings for the auxiliary gears and drives, as well as the pistons, are made of special ALUMINUM or MAGNESIUM alloys. These are usually CASTINGS, but FORGINGS are used to some extent where the part is of suitable shape. Aero-engine cylinder construction is of two general types; namely, that in which the cylinder head is an aluminum casting or forging screwed and shrunk onto a steel barrel, and that in which both cylinder barrel and head are composed of a single steel forging, the valve ports and valve gear supporting structure being in the form of an aluminum alloy casting clamped on top of the steel cylinder head.

C. F. T.

BIBLIOGRAPHY.—C. H. Chatfield and C. S. Taylor, *The Airplane and Its Engine*, 1928.

**AIRCRAFT INDUSTRY.** The aircraft industry has progressed in a series of waves of expansion, each receding after peak marks were reached, only to have a succeeding crest mount higher than any before. The development of the industry after the first flight of

heavier-than-air craft in 1903 continued at a slow pace until the World War, at which time the aircraft industry was built up, almost from nothing, to meet the demand for fighting planes. After the war, a large surplus of military aircraft glutted the market and "killed" production, despite the development of air mail. The industry remained inactive until favorable economic conditions in 1926 effected a new wave of expansion. This "boom" lasted until the economic depression which began in the fall of 1929. Notwithstanding an overproduction of planes which retarded manufacturing activities, and a surplus of pilots which caused many instruction schools to close, the foundation of aviation had been so well laid by 1929 that an annual increase has since been recorded in the number of passenger, mail, and express airlines and in the number of AIRPORTS and privately owned AIRPLANES.

AIRCRAFT INDUSTRY, U.S., 1914-1929

Year	No. Establishments	Wage Earners	Wages \$	Value of Products \$
1914 . .	16	168	134,827	789,872
1919 . . . .	31	3,543	4,906,740	14,372,643
1925 . .	44	2,701	4,222,151	12,524,719
1929 . . . .	132	14,710	21,923,844	71,152,924

During 1930 the various manufacturers produced 3,350 heavier-than-air craft, which included about 830 military planes. During that year the giant dirigible built by the navy, the *Akron*, was being constructed and was completed in the fall of 1931, work on its sister ship being begun at that time.

At the end of the first six months of 1931 there were 16,268 licensed pilots in the United States. That number includes 7,928 private pilots, 6,532 transport pilots, 1,741 commercial pilots and 67 industrial pilots. The number of pilot training schools approved by the Department of Commerce was 33. See also AIRCRAFT MANUFACTURE; AIRWAYS; AIR TRANSPORTATION; AIR MAIL SERVICE.

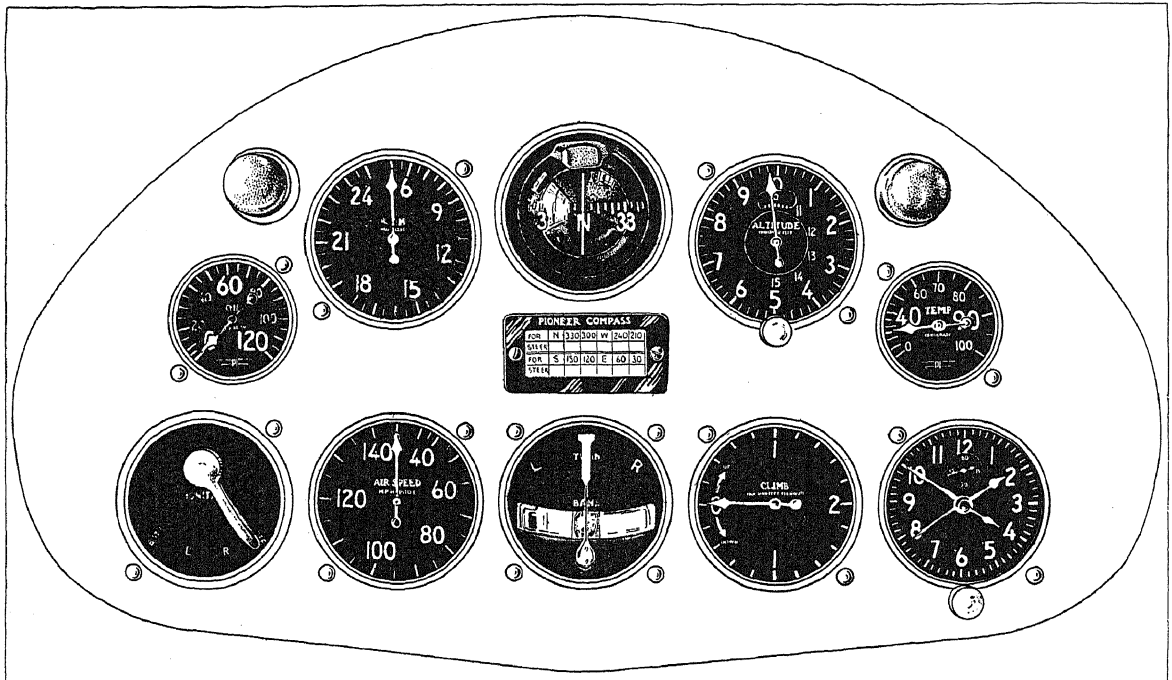
**Organization.** The aircraft industry, both military and commercial, includes Airship, Airplane and engine manufacturers, air mail, passenger and transport lines, operators, flying and ground schools and airports. The military airplane and engine factories are largely regulated by the military branches of the government. Operators having air mail contracts are regulated by the POST OFFICE DEPARTMENT and the DEPARTMENT OF COMMERCE. All other commercial activities are regulated entirely by the Department of Commerce, through its aeronautics branch. The trade organization of the industry centers largely in the Aeronautical Chamber of Commerce. The cross-licensing of patents is handled by the Manufacturers Aircraft Association. All sporting events and international record observations are handled by the National Aeronautic Association.

In 1929 there was a marked tendency toward financial affiliation and centralized control through mergers of engine and airplane manufacturers with

operating lines and other sales outlets, with the results that two important financial groups came into control of approximately two-thirds of the military and commercial aircraft manufacturing and the air mail and passenger lines of the United States. Engineering features are fostered by the American Society of Mechanical Engineers and by the Society of Automotive Engineers. Research is carried on by numerous laboratories and investigators, including the National Advisory Committee for Aeronautics. R. S. D.

**AIRCRAFT INSTRUMENTS**, measuring, recording and observational devices used in operating

World War in factories controlled by the government. At the end of the War production stopped abruptly, and amounted to almost nothing between 1918 and 1926. *See also* AIRCRAFT INDUSTRY. However, people were slowly becoming educated to the advantages of aviation, and at the end of 1929, 132 manufacturing companies were engaged in supplying the demand for airplanes in the United States, according to the official census. Many of these companies lacked the necessary engineering background and sound business management that would enable them to continue successfully, and when, in the fall of 1929, production



COURTESY PIONEER INSTRUMENT CO.

AIRCRAFT INSTRUMENT PANEL SHOWING OIL-PRESSURE GAUGE, MAGNETO SWITCH, TACHOMETER, AIR-SPEED INDICATOR, MAGNETIC COMPASS, BANK AND TURN INDICATOR, ALTIMETER, CLIMB INDICATOR, THERMOMETER (OIL AND WATER TEMPERATURE) AND CLOCK

**AIRPLANES and AIRSHIPS.** They include engine, flight and navigation instruments. In the first group are a **TACHOMETER**; an oil-pressure gauge, showing the pressure at which oil is being circulated in the engine; a fuel-pressure gauge, showing the pressure at which fuel is being supplied to the carburetor; and a thermometer, to indicate the temperature of the engine.

The flight instruments include an **AIR-SPEED METER**; a **TURN AND BANK INDICATOR**; a "climb" indicator, showing the rate at which the airplane is ascending or descending; and an artificial horizon, to indicate the attitude of the airplane about its lateral and longitudinal axis.

Aviation instruments include a **COMPASS**; a **DRIFT INDICATOR**; an **ALTIMETER**, and a **SEXTANT**. C. H. C.

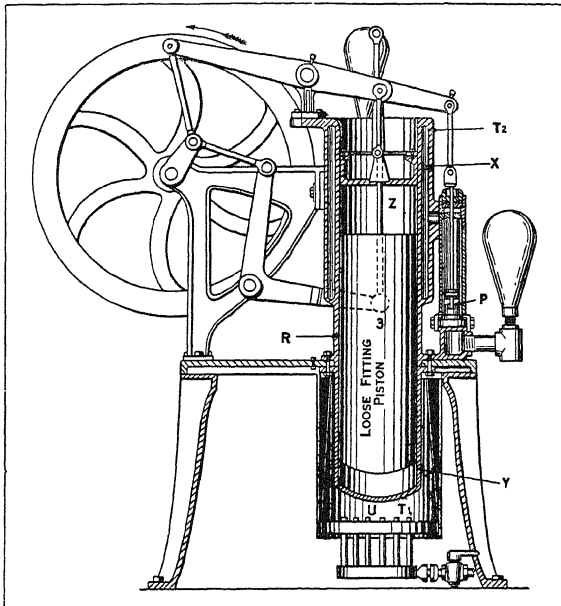
**AIRCRAFT MANUFACTURE.** Airplanes were manufactured in quantity for the first time during the

exceeded the demand these companies were the first to dissolve.

In 1930 manufacturers were vitally interested in reducing inventories, and the production of new models was small; the total number of aircraft manufactured was 3,350. Approximately two-thirds of the manufacturers dropped out of the field during the year, and the industry entered 1931 with production concentrated in the hands of approximately 50 active organizations. Inasmuch as large production is necessary to a profitable business, most of these manufacturers have established representation in the most promising territories in the country through dealers and distributors.

The manufacture of lighter-than-air craft has developed slowly on account of the high cost of such ships. In this country the use of airships is confined largely to army and navy service. R. S. D.

**AIR ENGINES**, a type of *external* combustion engine in which air is used as a medium to receive heat energy and convert it into mechanical energy. In the figure is shown a section of the Ericsson Hot Air Engine, in which two pistons *R* and *X* are employed. When the displacer piston *R* is up, most of the air charge is in the cylinder at *Y*, where it absorbs heat from the furnace *U* at a temperature *T*<sub>1</sub>. As the piston *R* moves downward, the hot gas flows up between the cylinder and the loosely fitted piston, into the top cylinder cavity *Z*. Here it expands and forces the working piston *X* upward, communicating



ERICSSON HOT AIR ENGINE

the movement to the fly wheel. On the next upward stroke of the lower piston this air, now reduced in pressure and temperature, is forced down to the lower cylinder where reheating takes place. The maximum obtainable efficiency is 10%, which compares favorably with small steam plants, but the weight of the machine is excessive, which has prevented its general use except in countries where wood is plentiful and gasoline expensive.

L. H. Mo.

**BIBLIOGRAPHY.**—C. F. Hirshfeld, *Elements of Heat-Power Engineering*, 1915; W. N. Barnard, F. O. Ellenwood and C. F. Hirshfeld, *Elements of Heat-Power Engineering*, 1926.

**AIR FLOW**, the movement of air away from regions of higher pressure to those of lower pressure. The velocity depends upon the pressure gradient and upon the resistance encountered. Difference of pressure may result from temperature difference, as in chimneys and natural-draft ventilation, or it may be maintained by fans or compressors. The resistances encountered depend upon the nature of the flow. In the simplest cases, where the flow is along streamlines, resistance is due wholly to the **Viscosity** of the air and is proportional to the velocity. More usually,

the resistance depends, in a complex manner, upon the degree of turbulence, which depends upon the size, smoothness and regularity of the air duct.

**Winds.** The natural flow of air near the ground is always exceedingly turbulent. At higher elevations it is more uniform as well as more rapid. All winds are deflected by the rotation of the earth and maintained by differences in barometric pressure which are, in general, due to differences in temperature.

**Natural-Draft Ventilation**, the familiar case of the flow of air in ducts due to temperature difference. The density of air at a constant pressure is inversely proportional to its absolute temperature; thus, a circulation will be set up wherever an inclosed body of air at a temperature different from that on the outside communicates with the exterior through openings at different levels. In such cases, the velocity of flow is proportional to the square root of the difference in level and also to the square root of the temperature difference.

**Forced Ventilation** is the case of flow in ducts under pressure difference maintained by fans or blowers. Both the velocity of the air and the resistances encountered depend upon the conditions of the particular duct. No general statements are of much value as a means of computing the power required to deliver air at a given rate. However, since the resistance increases with the square of the velocity, it is desirable to use ducts as large as is compatible with economy of construction.

**Flow of Compressed Air.** Compressed air for power purposes is delivered through circular pipes in which it flows at speeds up to about 1,200 ft. per min. The capacity of such a pipe is usually rated in terms of the cubic feet of free air which it can deliver per minute. F. Richards gives the following formula for computing this quantity:

$$V = \sqrt{\frac{2,000 d^5 (p_1^2 - p_2^2)}{l}}$$

where *V* is the volume in cubic feet per minute, *d* the diameter of the pipe in inches, *l* its length in feet, *p*<sub>1</sub> and *p*<sub>2</sub>, the absolute pressures at the ends in pounds per square inch.

**Flow in Small Tubes.** Poiseuille's Law (*see* **Viscosity**) states that when air or any other fluid flows slowly through a circular tube of small diameter, the flow is stream-line in character, and the resistance is wholly due to viscosity of the fluid. The layer of fluid in contact with the walls has no forward motion and the velocity increases toward the axis of the tube. Under these conditions the volume of fluid discharged per second is given by the relation

$$V = \frac{\pi R^4 P}{8 \mu L}$$

where *V* is the volume in cubic centimeters, *R* the radius of the tube, *P/L* the mean pressure gradient in absolute units and *μ* the coefficient of viscosity, 0.00018 for air at ordinary temperature. This relation has been extensively used as a means of computing the

coefficients of viscosity of fluids. The motion becomes turbulent and the law ceases to apply above a critical velocity which is given by

$$V = \frac{2,000 \mu}{2R\rho}$$

where  $\rho$  is the density of the fluid. A. A. K.

**BIBLIOGRAPHY.**—W. J. Humphreys, *Physics of the Air*, 1929; J. Weisbach and G. Herman, *Mechanics of Air Machinery*, 1905; L. B. Loeb, *Kinetic Theory of Gases*, 1927.

**AIRFOIL**, any surface, usually the wings or the tail surfaces of an **AIRPLANE**, designed to be projected through the air in order to produce a useful dynamic reaction. The characteristics of an airfoil depend largely upon the section made by a plane containing the direction of movement and the resultant air force. The actual characteristics of approximately 1,000 airfoil sections are now available, and include the variation in loading over the surface of the airfoil. The extreme range of maximum thickness of useful sections is between about 1/12 and about 1/5 of the chord, but the usual value is not far from 1/8 of the chord.

It is interesting to note that the reduction in air pressure over the upper surface accounts for 60% to 90% of the total lift and that the average wing section will carry 12 pounds per square foot at sixty miles per hour.

Airfoils are sometimes designed for changes in section or area during flight in order to increase the "lift" or to reduce the "drag." The general types are: Variable Camber, obtained either by a warping of the entire surface or by a movable flap on the trailing edge; Variable Area obtained by changing the chord or (rarely) by changing the span; Variable Area obtained by wing arrangement convertible from monoplane to biplane by expansion or unfolding; and Boundary Layer Control from slots operating either from existing pressure differences or from an external source of power. The only types now used to any extent or which give promise of future development, are the slots and the flaps, usually in combination. See also **AERODYNAMICS**. W. S. D.

**AIR FORCE.** See **MILITARY AVIATION**.

**AIR HOIST**, a hoisting device operated by compressed air usually consisting of a small reciprocating air motor that turns the hoisting drum, lifting the load by means of a steel cable. See **AIR LIFT**; also **PNEUMATIC TOOLS**.

**AIR LIFT**, a term usually applied to a cylinder in which a vertically set piston, actuated by compressed air, lifts loads. The term has also been applied to a method of raising water by forcing air down the well in one pipe so as to force the water up another pipe. See also **PUMPS**.

**AIR MAIL SERVICE**, a service maintained in the U.S. by the **POST OFFICE DEPARTMENT** to transport mail where a saving of time is the great factor. It serves practically every large city in the country. Three transcontinental routes, together with trunk and feeder lines, comprise a total of 25 routes over which planes fly approximately 70,000 miles every 24 hours, a great portion being flown at night.

The service is maintained entirely by contracts with commercial companies, payment being on a space-mileage basis. The appropriations made by Congress are administered so as not only to secure the speedy transmission of the mails but also to develop air transportation on a sound and conservative basis.

In Great Britain, the postmaster general, in 1919, established an air mail service between London and Paris, which has since been extended to Germany and other countries. Many European and South American countries have been active in developing air transportation of mail. See also **AIR TRANSPORTATION**, *Government Relations*. W. I. G.

**AIRPLANE**, a heavier-than-air machine which is sustained by wings, usually fixed, and propelled by an **AIR PROPELLER** operating in an approximately vertical plane. The general term includes **SEAPLANES**, **AMPHIBIANS** and "flying boats."

The aquaplane towed by a speed boat and the airplane pulled by a propeller are sustained by the same principal motion. With the plane, the surface of a wing, curved in cross-section, gives a downward momentum to the air passing over it, which results in an increased pressure on the bottom side of the wing and a decreased pressure or partial vacuum over the upper surface which results in a "lift."

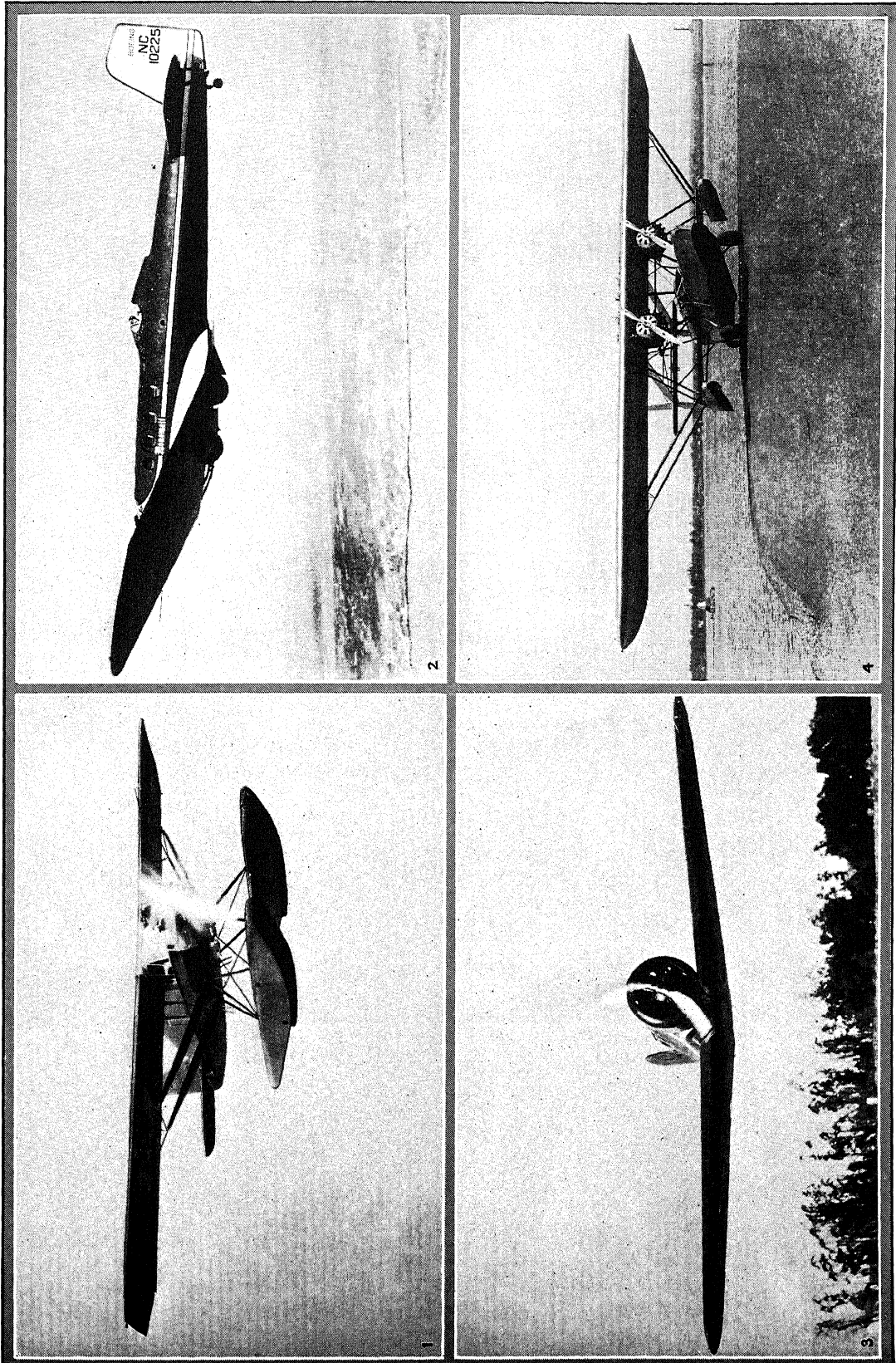
Directional control of an airplane is obtained by a rudder, which is a flap attached to the rear edge of the fin, the fixed vertical surface that produces directional stability. The ability to ascend or descend is secured from elevators or flaps, attached to the rear of the horizontal tail plane, the surface affording longitudinal balance or stability. To give lateral balance and the ability to bank, the rear portion of the wing is hinged, forming ailerons.

**Airplane Design** includes the planning and graphical construction of heavier-than-air craft. A properly proportioned design is the result of a series of compromises. An ideal airplane should have a high maximum speed, low minimum speed, a high rate of climb and a high ceiling; while carrying a large gross load in proportion to horse power. To satisfy the condition of low minimum speed, a large wing area is required for the weight carried. For high rate of climb and a high ceiling a low weight per horsepower and a low weight per foot of span are necessary, and for high speed the power must be high in relation to the resistance. An increase in speed usually requires a decrease in wing area which involves an increase in the *minimum* speed. An increase in rate of climb and ceiling requires a decrease in weight per horse power and therefore a decrease in economy. A successful airplane must, therefore, be a careful balance of the factors involved to give the best possible performance for the service for which the airplane is intended.

After the overall dimensions, the gross weight and the horse power for the required performance have been decided upon, the details of design must be carried out so that the largest useful load possible may be carried. To accomplish this, the structural design



# AIRPLANE



COURTESY BELLANCA AIRCRAFT CORP.; 2. PRATT & WHITNEY AIRCRAFT CO.; 3. DETROIT AIRPLANE CO.; 4. SIKORSKY AVIATION CORP.

## TYPES OF LATE MODEL AIRPLANES

1. Bellanca seaplane, 300 hp. Wright Whirlwind engine. Speed, 136 mi. per hour.
2. Hornet powered Boeing *Monomail* plane. Speed, over 200 mi. per hour.
3. Detroit Lockheed *Sirius* with landing gear fully retracted in order to eliminate drag.
4. Sikorsky model *S-4t*.



must be efficient, the weight per horse power and the fuel consumption of the engine must be low and the air propeller efficiency must be high. O. C. K.

**Airplane Structures.** The major structural elements of a conventional airplane are the body, wing, the tail-surface and the landing-chassis frameworks, each of which is usually a three dimensional truss. The typical body is a fabric-covered framework of steel, aluminum alloy or wood. In America it is usually composed of steel tubes joined by welding. In Europe, welding is seldom employed, and the variety of structural shapes and methods of connection is much greater. In many designs the body is a shell-like structure of aluminum alloy or plywood. The main wing beams and some minor wing members are usually made of wood in the smaller designs. Aluminum-alloy or steel construction is more frequent in the larger types. Both aluminum alloy and steel are used for connecting fittings and other minor wing parts. Wires are always steel. Wing coverings are generally made of treated fabric, though in some designs a thin-gauge aluminum alloy or plywood covering is used. Tail surfaces are similar to wings, though smaller. The typical landing chassis is a tripod of steel struts supporting each wheel, one leg including a shock absorbing mechanism. A. S. N.

**Airplane Performance** is the facility with which a plane executes the various elements of flying. The basic elements comprise the maximum and minimum speeds in horizontal flight at sea level and at various altitudes, and the time required to climb to various altitudes all with a specified weight and power. The time to climb to various altitudes determines the rate of climb at various altitudes, and from this in turn is determined the initial rate of climb at sea level, the *absolute* ceiling and the *service* ceiling. In addition, the performance may include ranges and endurances with a specified fuel load under various conditions, the most common being at maximum speed. The times required and distances run over the ground in "take-off" and landing are frequently included as a part of the performance. For multi-engine airplanes the data on rates of climb or maximum altitude that can be maintained with one or more engines stopped is generally included. W. S. D.

**Airplane Stability and Control.** An airplane is said to be *stable* if it returns to its original attitude when disturbed. It is *controllable* if the pilot can maintain any desired attitude within its speed-range. Since an airplane has six degrees of freedom, the problem of dealing with all the possible motions simultaneously is a very complicated one. However, longitudinal, vertical and pitching motion can be considered independent of lateral and directional motion.

The nature of the return motion of a stable airplane depends upon the relation between the restoring and the damping moments or forces. If the damping moment is small as compared to the static moment, the motion will be oscillatory, and in that case, when

the amplitude of the oscillations decreases with time, the motion is dynamically stable. Actually, oscillations occur only in longitudinal motion, and for that reason longitudinal stability is divided into static and dynamic stability. The lateral damping moments in unstalled flight are so large in relation to the restoring moments that the motion is aperiodic. Therefore dynamic lateral stability is never considered.

The "Gyroscopic Pilot," an instrument employing two high-speed, electrically driven GYROSCOPES, has been proven successful upon rigid test. Both gyroscopes—one mounted horizontally, the other vertically—wipe a series of electric contacts as the airplane departs from its normal, desired position, thus setting into operation, through relays, mechanisms which actuate the three major controls, thus restoring the craft to its proper position. The pilot is relieved of the responsibility of manually controlling the ship and has more of his attention to devote to watching his instruments and the condition of his motor. *See also* AERODYNAMICS; AUTOGYRO; AIRSHIPS. O. C. K.

**BIBLIOGRAPHY.**—C. N. Monteith, *Simple Aerodynamics and the Airplane*, 1929.

**AIRPLANE MANEUVERS**, any controlled movements of an AIRPLANE. They vary from straight flying to the most violent "acrobatics." "Acrobatic" flying is the intentional execution of maneuvers not necessary to AERIAL NAVIGATION. It is unnecessary for a commercial pilot to do acrobatic flying, but his training should be such as to enable him to extricate an airplane from any unnatural position in which it may be placed either through air currents or through the loss of a visible horizon or reference point. All pilots should know how to recover from a tail spin and should be taught to pull an airplane out of a dive gradually in order to avoid unduly stressing its members. A truly "finished" pilot should never permit an airplane to get out of control.

A military pilot's life depends largely upon his ability to maneuver an airplane. Consequently, his training includes a course in advanced acrobatic flying. J. H. D.

**AIRPLANE PHOTOGRAPHY.** *See* PHOTOGRAPHY, AERIAL.

**AIRPLANE PILOTAGE**, the art and practice of operating heavier-than-air craft. It is more difficult than driving an automobile, due to the fact that an airplane operates in three dimensions instead of two. In addition to the control for turning to right and left, there is one for ascending and descending and one for the lateral inclination of the wings, or banking. After one becomes accustomed to these two additional controls, they facilitate rather than complicate AERIAL NAVIGATION, because the pilot can avoid traffic congestion by changing his altitude and does not have to slow down when making a sharp turn, as the airplane can be "banked" just the proper amount to avoid "skidding." The idea that the pilot must be a superman, or gifted with a sort of sixth sense, is erroneous. Anyone with average physical abilities, can, after becoming accustomed to the con-

trols and the AIRCRAFT INSTRUMENTS required, fly a modern airplane as well as he can drive a car.

If one is taking up airplane pilotage as a vocation rather than an avocation, a long and extensive course of training is needed and mature experience required before he becomes a finished pilot. Over-confidence, recklessness and carelessness must be avoided, especially during training and immediately thereafter. This is the danger period when a pilot's ability is not commensurate with his belief in himself. The pilot who knows his limitations and is guided by that knowledge, will seldom experience difficulty in the air.

**Licensing of Pilots.** In the United States, Federal laws delegate to the Secretary of Commerce the power to issue pilots' licenses. According to these regulations, he must examine all pilots periodically, and must rate them as to their qualifications. Two classes of pilots are recognized; Commercial and Private pilots. Commercial pilots are further classified as: Transport Pilots, Limited Commercial Pilots and Private Industrial Pilots. All applicants must fill out a regular application blank which must give evidence as to his moral character, his age and his citizenship. It must also show that he has had sufficient training to qualify him for the class of license he is applying for, and that he is in good physical condition. All applicants must furthermore undergo a test which is calculated to prove his abilities. All licenses are issued for limited periods, renewable at the discretion of the Secretary of Commerce. A pilot must carry his license with him at all times when piloting, and he must also maintain an accurate record of his flying time.

J. H. D.

**AIRPLANE RACING**, the competition between aviators for speed records at regularly organized meets, a logical corollary of aeronautical progress. The first airplane races were held in Aug. 1909 at Rheims, France, for the cup offered by James Gordon Bennett. Up to that time the maximum speed was 78.7 miles per hour, a record set in a Blériot monoplane. The World War interrupted formal racing; but during hostilities the air forces of all belligerents concentrated on speed. As a consequence, all the old records were soon broken when airplane racing was resumed in 1920. In the latter year the Bennett cup was won by France, when Sadi Lecointe covered 300 kilometres (186.5 m.) in 1 hr., 6 min., 17½ sec. The same year, Lieut. C. C. Mosley, U.S.A., flying in the Pulitzer Trophy races at Mineola, L.I., covered 132 miles in 44 min., 29.57 sec. In 1925, in the Beaumont Cup Races at Istres, France, Sadi Lecointe established a speed of 194 miles per hour, and the same year Lieut. Cyrus Bettis, U.S.A., set a mark of 248.99 miles per hour in the Pulitzer competition at Mitchel Field, L.I.

In addition to various other races held in different nations yearly, which include the National Air Races in this country, and the *Deutsche Rundflug* in Germany, there is the international trophy for the Jacques Schneider Maritime Trophy. Between 1920 and 1929 the record speed of seaplanes was more than

trebled. This trophy, which was won in 1923 and 1925 by the United States, in 1931 was won permanently for Great Britain by Lt. J. Boothman, who averaged 340.08 miles per hour over the course at Calshot, England. Here also Lt. G. H. Stainforth attained a speed of 415.2 miles an hour. In the 1931 national air races held at Cleveland, O., Maj. J. H. Doolittle won the transcontinental air derby with an average speed of 218.81 miles per hour. The Thompson Trophy was won by Lowell Bayles, at 236.23 miles per hour.

Interest in airplane racing has grown steadily in all nations. Technical achievements in reducing wind resistance on wing and strut surface, and lessening engine weight without sacrifice of horse-power, have made possible the bettering of the previous year's speed record at each successive air race.

**AIRPORTS.** The U.S. Department of Commerce officially defines an airport as, "a locality of land or water which is adapted for the landing or taking off of aircraft and which provides facilities for the sheltering and repairing of aircraft; or a place regularly used for receiving or discharging passengers or cargo by air."

Airports are used for mail planes, transport, flying schools, air taxi service, sight-seeing, private planes and testing. The Department rates airports in seven classes, according to size and equipment. It also specifies that a regulation airport must be near the town or city it serves and must offer facilities for supplying gas, oil and water. There must be no obstructions around the boundaries and the center of the field must provide a clear landing circle at least a hundred feet in diameter. Such a field must have a wind indicator and the name of the city must be lettered on the field, together with direction arrows. A class "A" airport must have one hangar at least 100 x 80 feet with 18 feet clearance. In 1931 there were over 4,500 landing fields in the U.S. which included 453 municipal airports and 495 privately owned. The largest class "A" airport contained over 1440 acres.

An airport may be almost any size or shape, provided it is suitably oriented and graded. It should have take-off and landing areas of sufficient length, and, ideally, should contain a circle or triangle containing runways in at least eight compass directions, allowing departure in any direction according to the wind. The field should be compact, but in any case should have its longest dimension in the direction of the prevailing wind. Drainage is important and where the soil is soft it may be surfaced with cinders or finely crushed stone. Most up-to-date fields have runways of concrete.

As far as possible the ideal airport is on ground high enough to be above fog and so that the prevailing winds will blow away fog or smoke from any nearby factories. It is important that there be no obstructions such as buildings, trees, power wires or radio masts which might interfere with a rising plane.

The better class airports are similar in layout. On

one side are the hangars, administration buildings, gas and oil stations and wireless and meteorological station. Running in front of these is a concrete roadway to which short roadways lead from the hangars. In front of them and out in the field are the eight runways—the longest, following the prevailing wind is usually at least 2500 feet long and 500 feet wide. The field is outlined by beacons at night and the departing runways and landing circle are “flood”-lighted. Building tops are marked with arrows pointing to the nearest airport and a large “compass” arrow pointing directly north. Among the finest airports in the United States are those at Wichita, Kansas City and St. Louis.

**AIR PROPELLER** or **SCREW**, a device for providing a thrust, at the expense of power generated by a motor, for driving an **AIRPLANE** or an **AIRSHIP**. The air propeller is similar in its action to the marine screw propeller, but the blades are much narrower and have cross-sections of **AIRFOIL** form.

The force which drives the aircraft is the reaction obtained when a mass of air is set in motion by the propeller. This backward moving air, or slipstream, has kinetic energy which represents a power loss. Other power losses are caused by a rotation imparted to the slipstream, skin friction and turbulence. The useful power, thrust times the velocity of advance, is, therefore, less than the power delivered by the engine, and the ratio of useful power to engine power,  $TV/P$ , is the efficiency. When the propeller operates in the presence of a body, the drag of the body is increased so that the thrust effective for propulsion is  $T - D$ , and the propulsive efficiency is  $\frac{(T - \Delta D)V}{P}$ . If the

velocity of the propeller tips greater than about 0.9 the velocity of sound, a severe loss in efficiency occurs due to the compressibility of the air. *See also* **PROPELLER THEORY**. F. E. W.

**AIR PROPELLER STRESSES** are caused mainly by the air load—or the amount of the thrust exerted by the propeller—and by the centrifugal forces accompanying rotation. The ordinary theory of bending is usually used to compute the stresses, but for reasonable accuracy it is also necessary to consider the centrifugal forces. These forces reduce the stresses somewhat, for they tend to straighten the blade that is bent by the air load. On account of the pulsating **TORQUE** of the **INTERNAL COMBUSTION ENGINE** and the constantly varying nature of the air load—due to the fact that “air-pockets” and other irregularities exist at all times—the stresses are far from uniform during flying. Furthermore the allowable stresses must be well within the fatigue limit (*see* **STRENGTH OF MATERIALS**) of the material employed. *See also* **MECHANICS**; **PROPELLER THEORY**. F. E. W.

**AIR PROPULSION**, the motivation of land, water or air vehicles by means of **AIR PROPELLERS** or rockets. In a number of instances air propellers have been applied to motor boats; generally in order to obtain a high rate of speed in shallow water. They have also been applied experimentally to railway cars

and are used to some extent on ice boats. *See also* **ROCKET PROPULSION**; **AERODYNAMICS**; **AIRPLANE**; **AIRSHIP**.

**AIR PUMP**. *See* **VACUUM PUMP**.

**AIRSCREW**. *See* **AIR PROPELLER**.

**AIRSHIP**, a self-propelled aircraft supported mainly by buoyancy derived from **AEROSTATIC** forces. The essential parts of an airship include a streamlined hull having one or several compartments inflated with a gas lighter than air; a propelling system consisting of **INTERNAL COMBUSTION ENGINES** and **AIR PROPELLERS**; fins and rudders for controlling the motion of the ship; accommodations for the crew and passengers; and instruments and apparatus for navigation and control.

Airships are classified as: Rigid, Semi-rigid and Non-rigid. The larger ships are rigid, the hull generally comprising a framework over which a fabric outer cover is drawn smooth and tight. The buoyant gas is contained in several fabric cells within the hull. The first rigid ship of the metal clad type, the U.S. Navy ZMC-2, was launched in 1929. This ship is built of metal strips wound helically about a duralumin (*see* **ALUMINUM**) framework of transverse and longitudinal members. The special material used for these strips is composed of a very thin sheet of duralumin coated on both sides with still thinner layers of pure aluminum to prevent the corrosion that renders duralumin brittle in a very short time. Contiguous strips are joined by “stitching” or riveting, a special machine having been designed for this purpose. The joints are made gas-tight with a **BITUMINOUS SUBSTANCE**, or mastic. This type of construction has proved, by actual tests, to be much more effective in holding the gas than the usual airplane fabric. Buoyancy is obtained by **HELIUM** gas contained in two balloonets, placed one in the bow and one in the after part, both together filling the entire volume.

Semi-rigid airships have a fabric envelope maintained in shape by internal gas pressure, assisted by a structural keel extending longitudinally along the bottom of the hull.

In non-rigid airships, the hull is merely an envelope of gas-tight fabric inflated to a pressure slightly above that of the atmosphere. The pressure is maintained by internal air compartments, which may be inflated or deflated while the ship is in flight.

The propelling system and control compartment of all types of airships are usually contained in cars suspended below the hull; but in rigid airships, these may be placed within the hull.

**Airship Design**. The first step in designing an **AIRSHIP** is to determine the gas volume necessary for the desired “lift.” Under average conditions, near sea level, the gross lift is about 0.062 pound per cubic foot of gas volume with **HELIUM** inflation, and about 0.068 pound per cubic foot with **HYDROGEN**. The ratio of useful to gross lift varies from about 25% in small non-rigid airships to about 50% in large rigid ships.

Approximately circular cross-sections are favored for

all types of airships, and the hull should be streamlined. A low ratio of length to diameter is conducive to maximum strength in proportion to weight, but excessively "fat" forms provide high resistance and make for poor control. In modern practice, the ratio is usually about 6 in rigid airships, and 4 in non-rigid.

The required engine power for a given speed may be determined by comparison with other airships, or by detailed calculations, based on WIND TUNNEL tests and other data. The necessary horse power varies as the cube of the speed and as the two-thirds power of the volume for geometrically similar ships.

**Airship Structures.** Rigid lighter-than-air craft have changed in shape since the World War from a long, slender, cigar-shaped structure with a length-diameter ratio of about 10 to 1 to a more "fat" streamlined structure with a length only five times the diameter. The new design gives much greater strength and less head resistance per unit of volume than the older type.

The rigid airship hull is built on a framework of longitudinal and transverse girders, triangular in shape, of the lattice type, made of one of the light aluminum alloys. The hull is divided into 15 or more compartments, each containing a cylindrical gas bag made of fabric and confined by wire netting. The whole structure is covered by a fabric treated with aluminum powder, which reflects the heat and protects the gas compartments. At the stern of the hull are elevators and a rudder for controlling the ship.

The passenger quarters are now placed inside the hull with the control car built below the hull near the bow. The engines in the latest design are placed inside and drive the propellers through shafts and gearing, but previously they were suspended outside. The fuel tanks and other supplies and equipment are carried within the hull.

Airship structures are subjected to transverse tensile and distorting forces due to the gas pressure and the "lift," and to severe shear and bending stresses due to aerodynamic forces. The first are easily calculated and provided for, but the latter are uncertain, because of varying air conditions, and the structure is designed for hypothetical maximum forces with a generous factor of safety.

**Airship Stability and Control.** A streamlined structure, such as an airship, if left unprovided with suitable fins and rudders, will turn its long axis at right angles to its direction of motion, and vertical and horizontal fins and rudders must be provided to control it. These movable control surfaces must be sufficiently large to bring the ship out of the sharpest turn into which it may be thrown by turbulent air. Fortunately, the motion of turning creates forces which partially offset the turning moment created by a deviation from the straight line course. Static stability is provided by having the center of gravity sufficiently far below the center of buoyancy. Any freedom of the gas to surge longitudinally lowers the virtual position of the center of buoyancy. Provision

against such action is generally made by enclosing the gas in "balloonets," or compartments. *See also* AIRSHIP PILOTING; AERODYNAMICS; AIRPLANE. C. P. B.

**AIRSHIP DOCK** or **SHED**, a building in which a modern airship can be sheltered, serviced and repaired. These sheds, containing room for spare parts, tools, supplies, helium gas tanks, and quarters for guards and mechanics, are usually built of galvanized iron on a steel framework. The roof is fireproofed, the floor of concrete. In order to handle the ships easily the longitudinal axis must be in line with the prevailing wind. A revolving shed nearly 500 feet long, built at Nordhotz for Zeppelins, was not a great success. A mooring mast running on rails from the great Akron shed into the open makes it possible to handle the greatest of airships without the large ground crew once necessary. The Akron shed, by far the world's largest, is 1175 feet long, 325 feet wide and 197 feet high. Specially designed doors have two leaves which together make a quarter hemisphere. They weigh several hundred tons each and are moved on a track by electric motors.

**AIRSHIP PILOTING**, the operation of lighter-than-air craft. It involves, fundamentally, both theoretical and practical knowledge of aerostatical and aerodynamical principles (*see* AEROSTATICS; AERODYNAMICS) as well as the knowledge of navigational practice and the ability to interpret weather maps, data and indications.

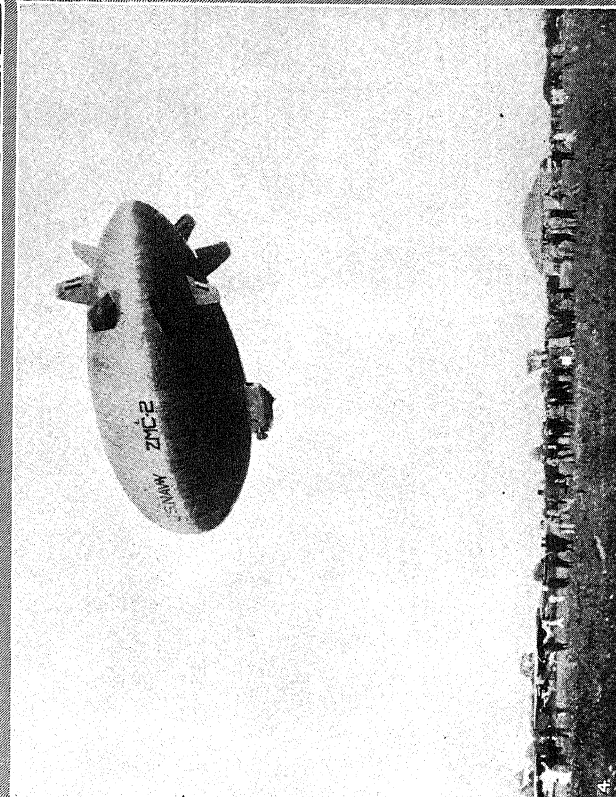
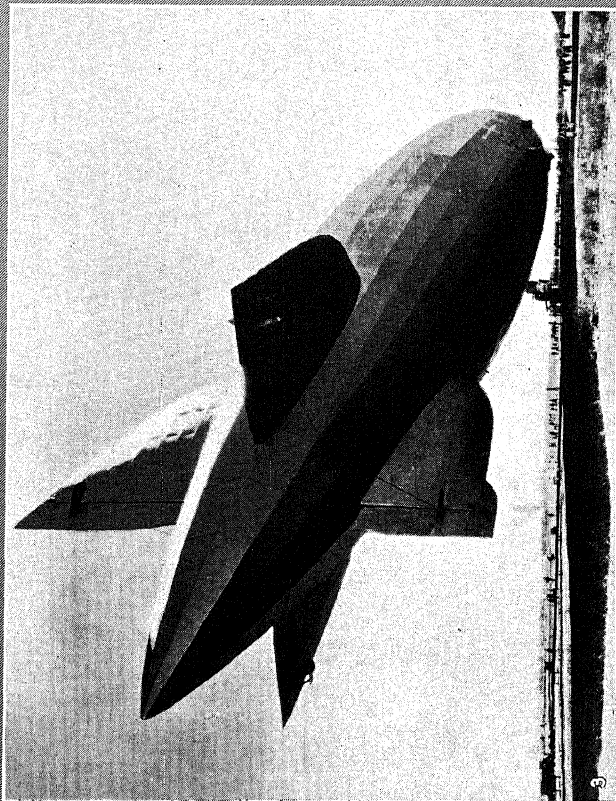
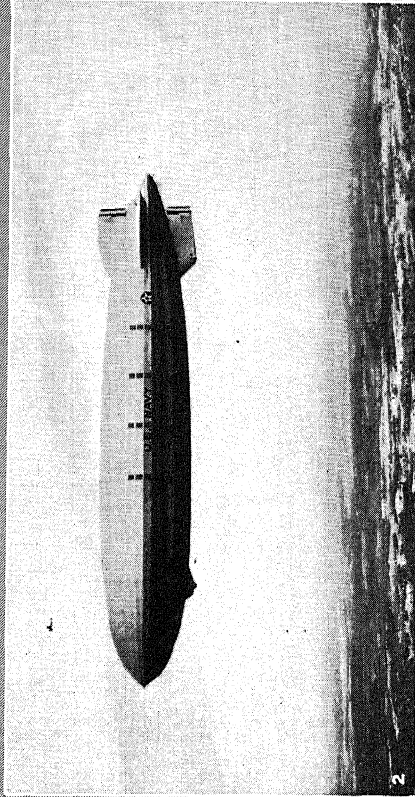
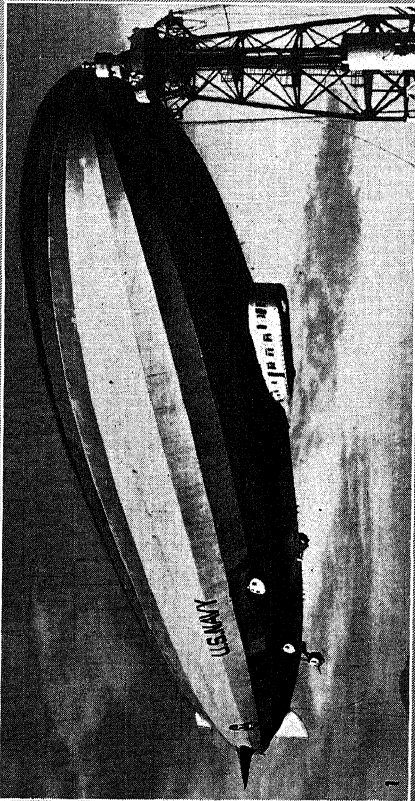
Since the airship is a dirigible balloon and, as such, derives its static lift or buoyancy from the relative densities of air and of gases lighter than air, airship operators must have a working intimacy with atmospheric structure and aerostatics—particularly those laws of physics that pertain to the variations of gas densities. Archimedes' principle (*see* FLOATING BODIES, EQUILIBRIUM OF), CHARLES' LAW and BOYLE'S LAW find constant application.

Once in flight, temporary changes or fluctuations in the buoyancy or load may generally be corrected by the aerodynamic properties (dynamic lift) of the ship; hence for this and other apparent reasons, a knowledge of airship aerodynamics is essential.

Airship navigation, the science that affords the knowledge necessary to conduct a ship from point to point on the earth and to determine the ship's position at any time comprises: "Piloting" or ascertaining position from visible objects on the earth; "dead reckoning" in which the position at any moment is deducted from the direction and amount of a vessel's progress from a known point of departure; and "nautical astronomy" by which the position is determined by the aid of celestial bodies. Because of the relatively high speed of the craft and the changing character of winds, continuous attention must be paid to the navigation of an airship. The measurement of "drift" or the angular offset due to wind, and of "ground speed" as distinguished from "air speed" occupies the navigator almost constantly. Navigation by the heavenly bodies may be done essentially as on surface craft but by instruments adapted to aerial use



# AIRSHIP



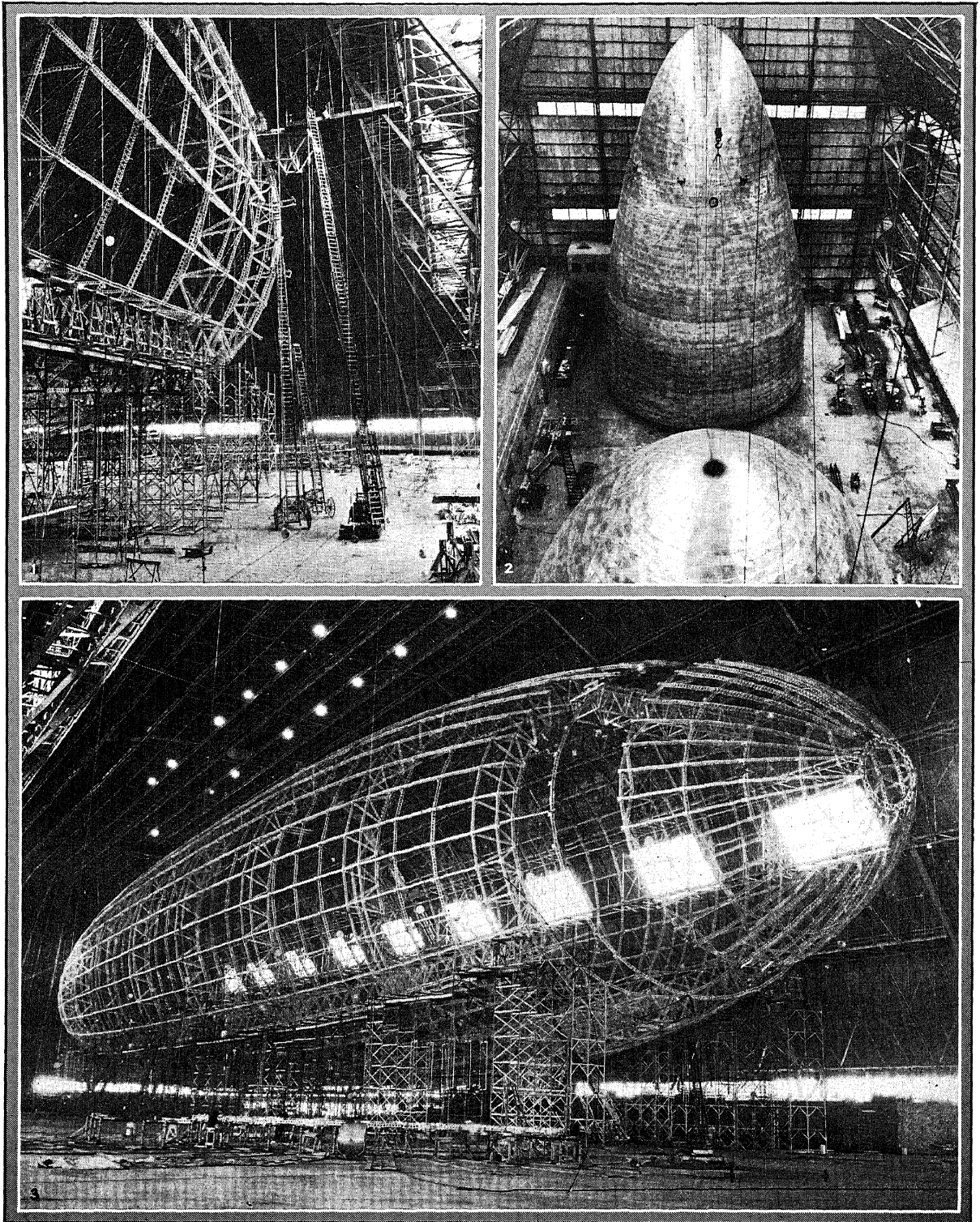
1, 2, 3, PHOTOS FROM EWING GALLOWAY, N. Y.; 4, COURTESY AIRCRAFT DEVELOPMENT CORPORATION

## MODERN AIRCRAFT

1. The *Los Angeles* anchored to the mast of her mother ship, the *Patoka*.
2. The *Akron*, the largest dirigible in the world in 1932.
3. The *Graf Zeppelin* on its round-the-world flight.
4. Trial flight of the metal clad ZMC-2.



## AIRSHIP



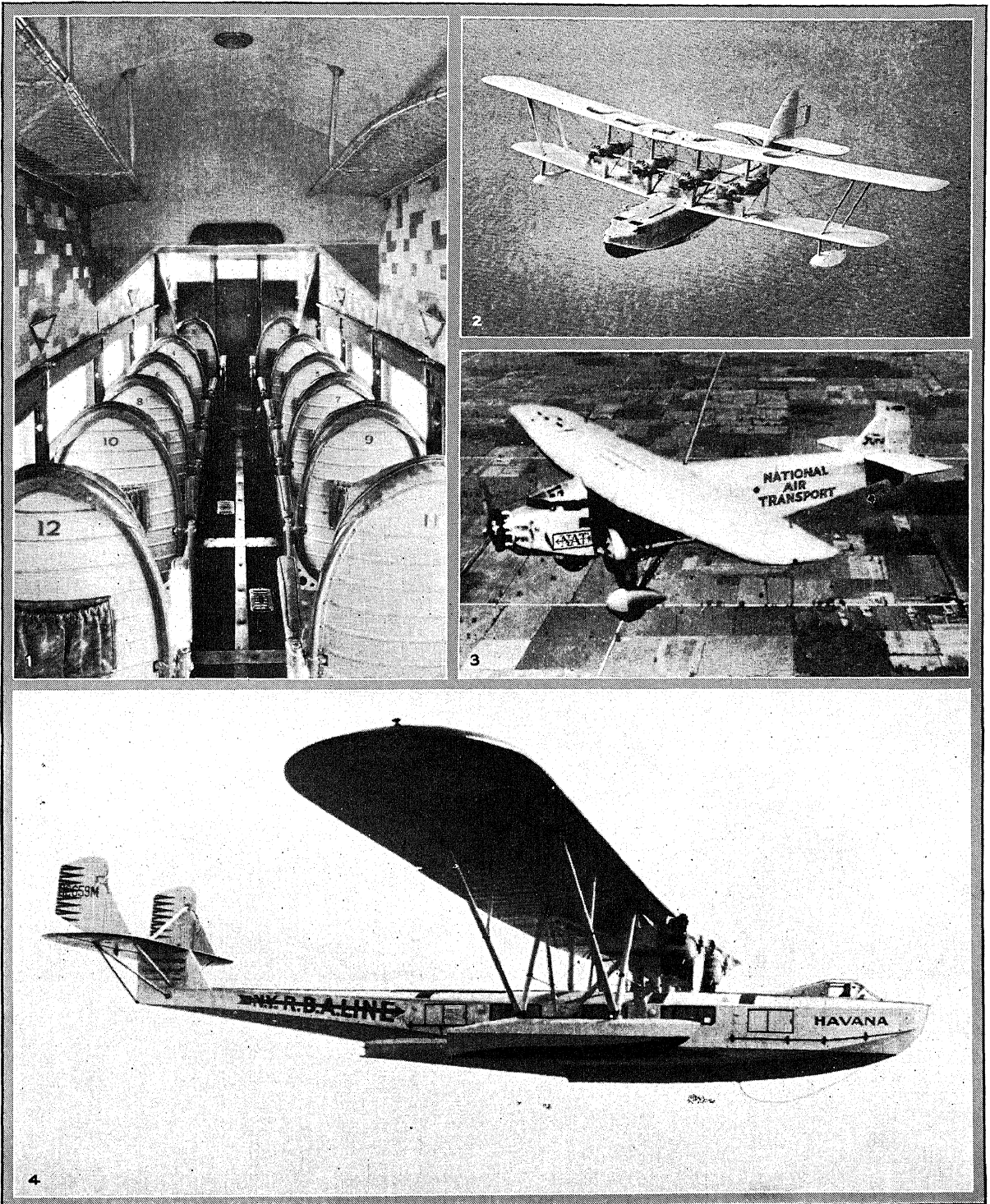
1. 3. COURTESY GOODYEAR ZEPPELIN CORP.; 2. DETROIT AIRCRAFT CORP.

### AIRSHIPS IN PROCESS OF CONSTRUCTION

1. Early construction of the framework of the ZRS-4, later christened the naval ship *Akron*. 2. Sections of the ZMC-2, a metal-clad ship built for the U. S. Navy. As the sections

are completed they are tipped over and sewn together by a riveting machine. 3. Framework of the *Akron* in its almost complete form before receiving the outer covering.

## AIR TRANSPORTATION



1, COURTESY FORD MOTOR CO.; 2, COPYRIGHT CHAS. E. BROWN, COURTESY IMPERIAL AIRWAYS; 3, COURTESY PRATT & WHITNEY AIRCRAFT CO.; 4, CONSOLIDATED AIRCRAFT CO.

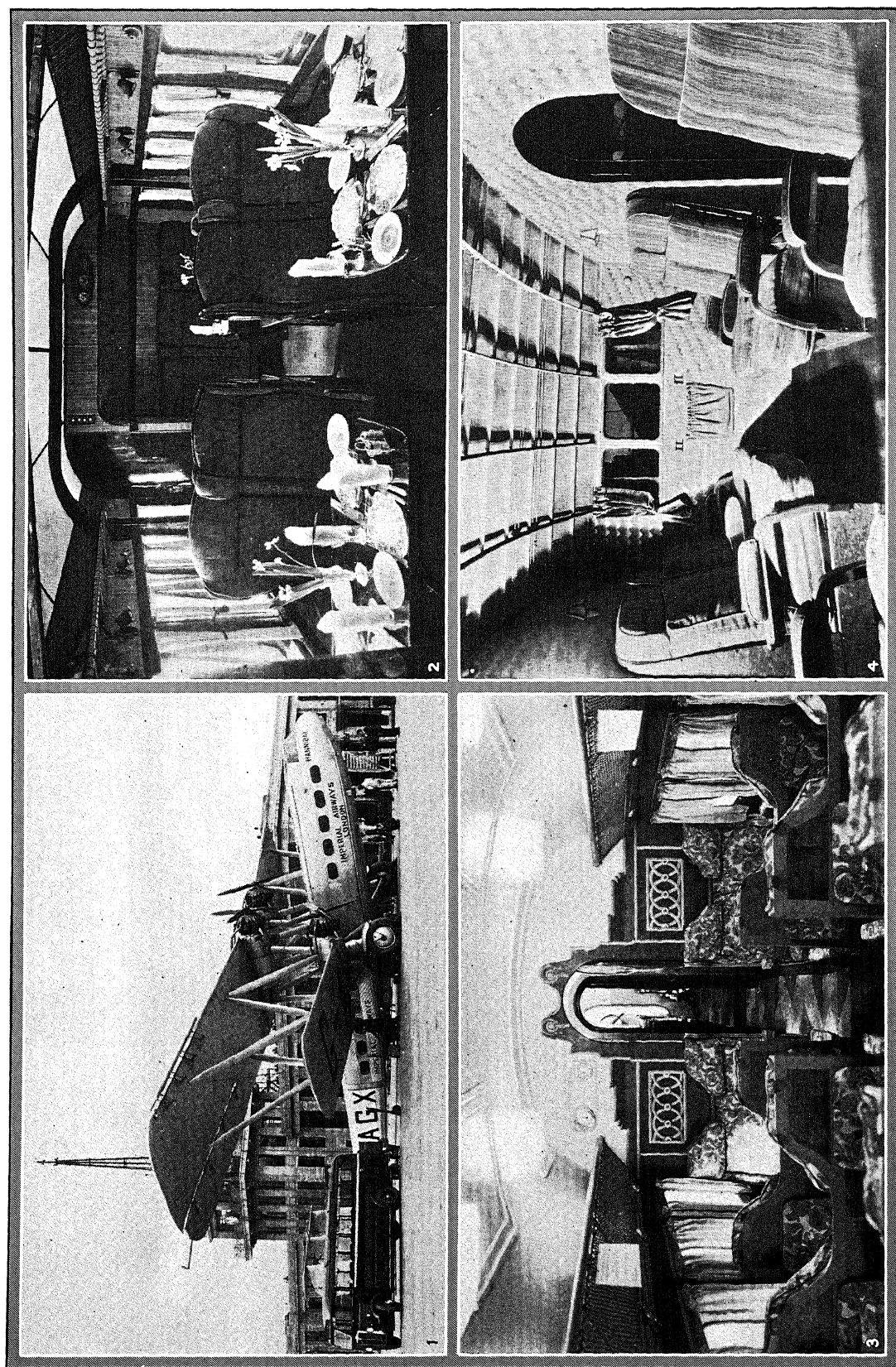
### PLANES USED IN COMMERCIAL TRANSPORT SERVICE

1. Interior of standard Ford tri-motored plane. 2. The *Scipio*, a flying boat of Imperial Airways in Mediterranean Sea service to India and Africa. 3. Twelve-passenger Ford tri-motored plane on the National Air Transport transcon-

tinental line. This type of plane is in wide use on American transport routes. 4. Commodore flying boat of the type in service on the Pan-American Line out of Miami to points of eastern South America.



# AIR TRANSPORTATION



1. COPYRIGHT AIR VIEWS, LTD., FROM IMPERIAL AIRWAYS, LTD.; 2, 3, 4. COURTESY IMPERIAL AIRWAYS, LTD.

## MODERN AIR PASSENGER TRANSPORTATION

1. *Hannibal*, a type of fast air liner on the London-Paris route.
2. Luncheon in mid-air; roomy interior of a flying boat.
3. Luxurious lounge room of the *Hannibal*.
4. Large upholstered seats of a passenger plane.

and generally by more rapid methods of calculation than are commonly employed on sea-going craft.

Since airships are long-range carriers for such distances as oceanic expanses, it is practicable and prudent for them to shape their courses to take advantage of favoring winds as well as to avoid the dangerously severe conditions. Consequently, the utilization of weather maps and weather knowledge for the prediction and recognition of both favorable and unfavorable features enters heavily into successful long-range flying operations.

The airship pilot must likewise have a full working knowledge of landing and ground handling practices just as the surface ship captain must know his harbor seamanship.

The "pilot" or captain of an airship performs duties analogous to those of the captain of a seagoing vessel.

C. E. R.

**AIR-SICKNESS**, a condition resembling sea-sickness occurring during an aeroplane flight. The usual symptoms are headache, nausea and vomiting. The latter may persist, causing prostration.

Changes in air pressure cause sudden and unusual movements of the plane, affecting the semicircular canals of the internal ear, the organs which aid the body in maintaining balance. Air-sickness is believed to be largely due to the difficulty of adjustment of these sense organs to the usual movements. Air-sickness is likewise due to the same cause as ANOXEMIA; that is, lack of oxygen, which at flying heights is as rare as in high mountains. In addition, psychical factors, such as fear of its occurrence, may play a rôle in producing the disorder.

**AIR SPEED METER**, a differential pressure gauge actuated from a pitot-static head (*see* PITOT TUBE) which resolves air velocity into its equivalent pressure, is used on aircraft to measure speed. It consists essentially of a diaphragm, one side of which is subjected to the dynamic pressure transmitted from the pitot tube, the other side being subjected to static pressure. A multiplying LINKAGE connects the diaphragm to a pointer.

More important to the airplane pilot than the measurement of speed is the fact that the indications of an air speed meter are always proportional to the "lift" of the air on his plane's wings.

**AIR TRANSPORTATION**. Over 60 years ago, BALLOON flights were not uncommon, but they were impractical. The early years of this century saw marked progress in lighter-than-air navigation due largely to the contribution of Count Zeppelin in Germany. Development of lighter-than-air flying has been slow largely because of the higher cost, but it has become technically successful. The first practical development of heavier-than-air ships was made by the Wright brothers in 1903. Both heavier-than-air and lighter-than-air navigation have received a tremendous forward impetus due to the military desirability of both types of aircraft which has resulted in government subsidies.

Europe as well as America has taken to the air-

plane as a means of practical transportation for mail, express and passengers. During the years immediately following the World War, Europe led in this development, but America has since taken the lead. Letters, express packages and passengers are now carried between all important American cities in the air at speeds which average approximately 125 miles per hour. However, speaking generally, the American public, either because of high fare or fear of flying, has not taken to the air for passenger carriage as enthusiastically as might be desired. However, air transportation is an established means of travel. It is not too much to expect that in 15 to 25 years, the greatest number of the people traveling from city to city in the large countries will travel rapidly, comfortably, safely and inexpensively by air.

**Economics of Air Transportation**. Since an airplane must be supplied not only with POWER sufficient to sustain it in the air but also to propel it at high speeds, the cost of air transportation is out of proportion to the cost of any other type of transportation. Consequently, it finds itself existing on government aid. In Europe, government aids take the form of direct subsidies; in the U.S., in the form of contracts for carrying mail. Governments find justification for this assistance to air transportation in the fact that the airplane is essential to military and naval operations. However, future development will undoubtedly wholly or partially eliminate the necessity for subsidies. *See also* AIR MAIL SERVICE. P. HE.

**Government Relations**. The Federal Government's interest in civil and commercial aeronautics is centered primarily in the DEPARTMENT OF COMMERCE and the POST OFFICE DEPARTMENT. The former is charged with the development of aids to AERIAL NAVIGATION, including airways, intermediate landing fields and aeronautic radio; the regulation of scheduled interstate air passenger service; the licensing of airmen and aircraft and general promotional work. The latter is identified with the transportation of mail by aircraft.

Under regulations promulgated by the *Aeronautics Branch* of the Department of Commerce in May, 1930, each operator of a scheduled interstate passenger airline is required to hold a certificate of authority. To qualify for and retain this certificate, the airline is required to meet prescribed standards of skill and experience of personal adequacy of equipment, ground organization and methods of operation.

In addition to enforcing these regulations, the Aeronautics Branch licenses airmen and aircraft and promulgates and enforces air traffic rules, and these functions are concerned with the mail, passenger and express airlines as well as flying operations of non-scheduled types.

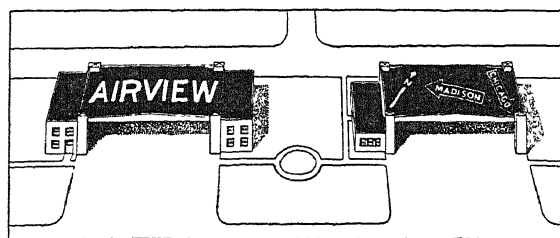
The Post Office Department contracts with commercial operators to transport air mail, and it routes and controls the air mail service. G. G. B.

**AIRWAYS**, routes for the operation of aircraft between principal cities, laid out over the best flying terrain and provided with AERIAL NAVIGATION facili-

ties. The facilities consist of proper terminal Airports and intermediate landing fields, lighted for night flying, beacon lights at the commanding points and at the location of hazards along the route, radio range beacons and weather collection and radio dissemination service for pilots in flight. Intermediate landing fields are located at intervals of 50 miles. These have four-way landing strips, a half mile or more in length, a beacon light, course lights, boundary lights and an illuminated wind indicator. Airway beacons are located at 10 to 15-mile intervals. Radio beacons are installed about 200 miles apart at the terminals, and mark the airways as well as provide "homing" signals. Radio stations 200 miles apart broadcast weather information hourly.

The navigable air space was established by the Air Commerce Act of 1926, and is fixed at altitudes above 500 feet in rural communities and above 1,000 feet in municipalities, except when in landing or taking off.

**Airway Markings** consist of graphical devices located on air routes and serving to give pilots their position enabling them to orient themselves. Names of municipalities are painted in contrasting colors on roof surfaces of outstanding buildings in 10 to 30



COURTESY U.S. DEPT. OF COMMERCE

TYPICAL HANGAR ROOF MARKINGS

feet letters. A *meridian marker* consists of an arrow with the letter N, painted in contrasting colors, indicating true north. Arrows point out the direction of airports and along with these arrows are circles inscribing the ratings of the ports in letters and numerals 6 to 30 feet in height. The distance to an airport is given at the point of the arrow. Markings are illuminated for use at night.

**Night Lighting of Airways.** Night air-line operation requires a comprehensive system of lighting to mark the courses, indicate the landing fields and hazards, and give the pilot information concerning other aircraft in the air and on the ground. Airway beacons are placed at commanding points along the route 10 to 15 miles apart. These are electrically operated, are lighted from dusk to dawn, and use commercial power where available. The standard beacon is 36 in. in diameter, has dioptric, range type lenses, and is equipped with doublets using 1,000-watt monoplane filament lamps, rotating 6 r.p.m. and developing 1,250,000 candlepower at a 6° beam spread. Auxiliary code lights are used to identify the beacon, showing green flashes at landing fields and red flashes where no landing can be made.

At landing fields white or yellow lights outline

the limitations of the landing area, and green lights range the best runways, hazards being marked at obstruction height with red lights. Lighted wind indicators show wind direction and velocity. Airports and terminal fields are usually provided with a flood-light system illuminating the landing area to a minimum intensity of .15 foot-candles.

**Radio Direction Finding on Airways.** There are several systems of radio direction finding used in connection with aircraft. In Europe, direction finders at ground radio stations take bearings simultaneously on a radio signal transmitted from the aircraft and, by exchanging data and by plotting on maps or charts, locate the craft by the intersection method. The position is then communicated to the pilot. Radio compasses are sometimes carried aboard aircraft to take bearings on radio stations, marine radio beacons or aircraft carriers, but this system has heretofore had only limited application. In the U.S. radio-range beacons provide radio direction to aircraft flying established airways.

Radio-range beacons are established adjacent to terminal airports about 200 miles apart and serve as homing devices. The earlier types transmitted aural signals and the more recent type low-frequency modulated signals actuating a visual instrument aboard the aircraft. These beacons are usually interrupted at 15-minute intervals for identification and weather broadcasts.

From the nature of the signals received the pilot can locate the course or determine his approximate bearing off course and locate the radio-range station alongside the terminal airport without being affected by low visibility or wind-drift.

F. C. H.

**AISNE**, a river of France, rises in the department of Meuse and flows 175 mi. northwestward and westward through the departments of Marne, Ardennes, Aisne and Oise, passing through Vouziers and Soissons, and is joined by the River Oise near Compiègne.

**AITKEN, ROBERT GRANT** (1864- ), American astronomer, was born at Jackson, Cal., Dec. 31, 1864. He was graduated from Williams College in 1887 and in 1895 was appointed astronomer at the Lick Observatory where he became associate director in 1923. In 1907 he was a member of the eclipse expedition to Flint Island. He published many articles concerning his special field of research, double stars, of which he had discovered some 3,000. His book *The Binary Stars* was published in 1918.

**AIX**, also called Aix-en-Provence, an old French city which marks the first settlement of the Romans in Gaul, situated in the department of Bouches-du-Rhône, southeastern France. Baths were established here about 124 B.C. by the consul Sextius Calvinus, and called Aquae Sextiae; hence the name Aix. On its site the Roman Marius defeated the Teutones and Cimbri. In the 4th century the town was supplanted in importance by the nearby Arles, but in the 13th century the counts of Provence made it their capital. Although invasions of the barbarians destroyed most of its classic monuments, Aix still contains treasures

from its rich past. Its Gothic cathedral of St. Sauveur was built in the 11th-14th centuries. Industrially, the town is noted for its olive oil, flour, mineral water and for its baths. The University of Aix-Marseille maintains its faculties of law and letters at Aix, which is also the seat of an archbishop. Pop. 1931, 38,332.

**AIX-LA-CHAPELLE.** See AACHEN.

**AIX-LA-CHAPELLE, CONGRESSES OF.** The Congress of 1668 resulted in the treaty of May 2, ending the War of the Devolution between France and Spain, restoring Franche Comté, Cambrai, Aire and Saint-Omer to Spain and leaving France all the conquests made in Flanders in 1667, with all their "*appartenances, dependances et annexes*," a provision whose vagueness furnished the pretext for numerous other acquisitions through the decisions of the *Chambres de reunion* under Louis XIV.

The Congress of 1748, in which the preliminaries were agreed upon on Apr. 24 and ratified Oct. 18, ended the WAR OF THE AUSTRIAN SUCCESSION between France, Prussia and Spain on the one hand and England, Austria and Holland on the other. The PRAGMATIC SANCTION was renewed, and the *status quo ante bellum* was generally restored. Frederick the Great of Prussia retained Silesia and the county of Glatz, England, secured a recognition of the Protestant succession and a renewal of the Asiento contract, i.e. the right to send annually a vessel to the Spanish colonies, and in Italy the duke of Modena and the republic of Genoa were restored to their former positions and the duchies of Parma, Piacenza and Guastalla assigned to Don Philip.

The Congress of 1818, opening Sept. 30 and ending Nov. 22, derives its chief significance from the fact that it defined the CONCERT OF POWERS, a system of international procedure established by the treaty of the Quadruple Alliance of 1815, and at the same time illustrated its working. At the Congress, Castle-reagh, the British Foreign Minister, restated the principles that were to guide European diplomacy throughout the 19th century, but their application in the subsequent congresses was defeated by the isolationist policy of the British government, through which Tzar Alexander I of Russia was brought under the reactionary influences of Metternich, the Austrian representative. The powers of the Quadruple Alliance,—England, Austria, Prussia, and Russia,—arrogated to themselves the functions of the Congress, which resulted in the evacuation of France by the army of occupation, the admittance of France to the European states system, the political liquidation of the treaties of 1815, and the consideration of numerous other economic, political, territorial and social questions.

**AIX-LES-BAINS,** a fashionable health resort, situated in the department of Savoie, eastern France. Aix-les-Bains lies in a verdant countryside near the small Lac du Bourget, at an altitude of 835 ft. Its waters are employed in the treatment of rheumatism, and as a health resort it was known to the

Romans. The season is from June to September, but the mildness of the climate makes Aix popular in spring and autumn also. Because of its proximity to Mont Revard, it has become a winter sport center. The number of visitors is over 50,000 annually. Pop. 1931, 13,020.

**AJACCIO,** the capital of the island of CORSICA, which since 1811 has formed one department of France. The town is beautifully situated on a protected bay at the foot of mountains on the west coast of the island and is frequented as a winter resort. Napoleon Bonaparte was born here. Cigars and macaroni are the chief manufactures and there are fisheries of both sardines and coral. Pop. 1931, 23,917.

**AJAX,** a Greek hero, the son of Telamon, king of Salamis. In physique he was surpassed only by Achilles. For the manner of his death see ACHILLES.

**AJMERE,** a city of British India in Rajputana, picturesquely situated on Taragarh Hill in the Aravalli Mts. In general aspects the present Ajmere is distinctly modern, with wide streets and attractive residences; but there still remain the tomb of the famous Mohammedan saint Muin-ud-din-Chishti, containing beautiful fretwork marble; and a Jain temple. Of interest, too, is the sacred lake of Pushkar. At Ajmere is one of the four colleges for the education of young Indian princes founded by Viceroy Mayo. Its plan is to retain caste distinctions, and yet provide an entirely modern scientific education on the English school basis. Ajmere is the administrative center of the district, and a main line railway junction. Pop. 1921, 113,512; 1931, 119,305.

**AKAMAGASEKI.** See SHIMONOSEKI.

**AKAMNIK,** an American Indian tribe of the Upper Kutenai linguistic stock living, in the latter part of the 19th century, around Fort Steele and the St. Eugene Mission on the upper Kootenai River in British Columbia.

**AKANEEKUNIK,** an American Indian tribe speaking a dialect of the Upper Kutenai division of the Kutenai linguistic stock, and living in the latter part of the 19th century along the Kootenai River, Brit. Col.

**AKBAR, JELLALADIN MOHAMMED** (1542-1605), the greatest of India's rulers, was born in 1542. His father was Humayun, the son of BABER, the conqueror who, proceeding from Afghanistan, founded a new Mogul empire in India. When Akbar succeeded to an uneasy throne in 1556, he was only 14 years old. For seven years he made war, so establishing a realm that included much of Afghanistan, Kashmir, Bengal, the Punjab, Oudh, Gwalior, and indeed a larger area of India than had ever before acknowledged a single ruler. As an administrator, he reformed taxation, was severe in punishment for extortion, organized a feudal system, encouraged commerce, art, literature, and education, constructed roads, established a uniform system of weights and measures and enrolled an effective police force. His toleration was unusual. Himself a born Moslem, he

requested Portuguese missionaries from Goa to give him an account of the Christian religion and late in life he endeavored to institute a new faith, describable as a pure Deism so comprehensive that it included all other beliefs. His buildings were magnificent. After Akbar's death, the whole of this grandeur was deserted and today it is preserved as a historical monument. Akbar's other capital was AGRA, 5 mi. from which city lies Sikundra where his cenotaph in simple majesty rests on the roof of the impressive mausoleum. The inscription is "Allah Akbar" meaning, God is great. Akbar's successor was his son, Jahangir, who reigned from 1605 to 1626. Jahangir's son, Shah Jahan built the Taj MAHAL.

**AKISKEMIKINIK**, meaning "people of the two lakes," an American Indian group, a subdivision of the Upper Kutenai division of the Kutenai linguistic stock. They lived early in the present century at Windermere, Brit. Col.

**AKIYENIK**, meaning "people of the leggings," an American Indian group, a subdivision of the Upper Kutenai division of the Kutenai linguistic stock, living on the shores of Pend d'Oreille Lake, Idaho.

**AKKERMAN**. See CETATEA ALBA.

**AKRON**, a city of northeastern Ohio, and the county seat of Summit Co., situated on the Little Cuyahoga River, at an altitude of about 1,000 ft., 35 mi. south of Cleveland. The city, which occupies one of the highest points of land in the state, is surrounded by a hilly region dotted with picturesque lakes and streams. Four trunk railroads, traction lines, buses and a municipal airport afford transportation. While Akron has been a leading center of the rubber industry since 1869, when the pioneer rubber factory was established here by Dr. B. F. Goodrich, the advent of the automobile, with the immensely increased demand for tires and other rubber products, gave the city its greatest industrial stimulus. According to the census of 1930 its manufactures, which for 1930 had a total value of approximately \$539,344,000, included, in addition to rubber products, airships, machinery, zinc oxide, matches, food, and clay products. Publishing is important, and well-drilling machinery and gasoline lighting systems produced in Akron have a world-wide export market. Akron's wholesale concerns, 121 in number, distributed \$44,095,396 worth of merchandise. The retail stores, which did a total business of \$139,537,881, gave full-time employment to 11,151 people. The University of Akron, located here, is part of the city's free public school system. The old home of John Brown, the abolitionist, still stands in the western part of the city. The old Portage Trail, which was part of the boundary of the United States in 1785, is now marked by commemorative tablets and bronze figures of Indians at either end. Akron was founded in 1825 and incorporated as a village in 1836. It was chartered as a city in 1856. Pop. 1920, 208,435; 1930, 255,040.

**AKSAKOV, SERGEI TIMOFEYEVICH** (1791-1859), Russian author, was born at Ufa, Orenburg

Province, Sept. 20, 1791. His stories are largely autobiographical narratives, giving the history of an autocratic rural family before the liberation of the serfs. His works include *Chronicles of a Russian Family*, 1856, *Recollections*, 1856, and *Years of Childhood*, 1858. Aksakov died at Moscow, Apr. 30, 1859.

**ALABAMA**, one of the southern states of the United States popularly called the "Cotton State." It is situated between 30° 10' and 35° N. lat. and 84° 51' and 88° 31' W. long. On the north it is bounded by Tennessee, on the east by Georgia, on the south by Florida and the Gulf of Mexico, and on the west by Mississippi. Alabama comprises an area of 51,998 sq. mi., inclusive of 719 sq. mi. of water surface, with a maximum length of 336 mi. from north to south and of 175 mi. from east to west. In size Alabama ranks twenty-eighth among the states of the Union.



ALABAMA STATE SEAL

**Surface Features.** Alabama lies within the gulf coastal plain except for the northern and northeastern regions where the Appalachian Mountain province has its southern terminal. The Cumberland Plateau extends diagonally into the state from the northeast corner and is paralleled on the southeast by, successively, the Sand and Lookout mountains; a section of the Great Valley, locally known as the Coosa Valley, and a projection of the Piedmont Plateau. Separating this mountain province from the coastal plain is the fall line of hills. Immediately below the latter is the "black belt," a region of dark limestone soil admirably suited to growing cotton.

Except for a narrow area adjacent to the northern border which is drained by the Tennessee River, the state slopes southward and is drained into the Gulf of Mexico. The principal rivers are the TOBIBGEE and ALABAMA and their headstreams, the BLACK WARRIOR, Cahawba and Coosa. On the southern boundary there are 174 mi. of coast line indented by Mobile Bay.

The mean elevation of Alabama is 500 ft. above sea level. Cheaha Mountain, 2,407 ft. in elevation, on the boundary between Clay and Talladega counties is the highest point.

**Climate.** Because of its situation largely within the coastal plain and its small and low mountain area at the north, Alabama has a mild and comparatively uniform climate. The mean annual temperature for the state is 63.7° F. At Montgomery the average for January is 48.2° F. and for July 81.7° F. During the period, 1884-1930, the highest temperature recorded in Alabama was 112° F. and the lowest, -18° F. The average annual precipitation is 52.4 in. including 1.5 in. of snow. There are 246 days in the average growing season at Montgomery.



**Soil.** The state exhibits a variety of soils. In the "black belt" the heavy, black soil, rich in limestone, is particularly suited for the raising of cotton. This highly fertile area is found about 150 mi. north of the Gulf of Mexico and includes about 13,000 sq. mi. The valley of the Tennessee River possesses a soil largely composed of clays and loams which is excellent for the production of cereals. South of the Tennessee River, soil varies from red to gray loam with a clay subsoil. In the coal region the soil is prevalently sandy and in the districts adjoining the Gulf of Mexico the soil is also sandy and relatively poor. Areas of swamp land also are found in the state.

**Forests and Parks.** Approximately 32,000,000 acres out of Alabama's total land area of 32,818,560 acres were originally heavily wooded, chiefly with white and yellow pine. According to a 1929 estimate, 23,000,000 acres were timbered, but 4,000,000 acres of virgin forest still remained. Four state forests with a total acreage of 110 acres were presented to the state by lumber companies during 1926 and 1927. These are to be developed for recreational as well as demonstration and experimental purposes. The Alabama national forest in the northwest section of the state had a net area in June, 1930, of 122,419 acres. A 16,000-acre area in the heart of this forest has been made a game sanctuary. Alabama has six state monuments administered by the Department of Archives and History. Of these Horseshoe Bend, site of Andrew Johnson's victory in 1814 over the Upper Creek Indians; Fort Toulouse, site of the old Indian town of Taskigi and successively a war post of the French, British and Americans; and Fort Confederation, site of the French Fort Tombechee, are of historical significance. Montpelier, William Weatherford, and Manack Homestead are memorials.

**Minerals and Mining.** Alabama possesses extensive deposits of bituminous coal and red hematite iron ore. It is estimated that about one-fifth of the state is underlaid with coal beds. The coal and iron ore, which are mined chiefly in the vicinity of Birmingham, are basic factors in the industries of the state. With mineral productions valued at \$65,402,354 in 1929, Alabama stood nineteenth among the states, ranking second in graphite and bauxite, third in iron ore, fourth in marble, fifth in coal and sixth in lime. The principal products in order of value were coal, 17,943,923 tons, \$37,309,000; iron ore, 6,637,299 tons, \$12,575,113; cement, 5,228,947 bbls., \$5,911,031; clay products, \$4,001,633; limestone, \$1,886,790; sand and gravel, \$1,302,754; lime, \$1,223,623, and marble, \$653,940.

During 1929, 255 mines and quarries gave employment to 33,781 persons who received \$34,859,683 in salaries and wages.

**Agriculture.** Cotton is the chief farm product, with grains and vegetables next in importance.

In 1930, 17,554,635 ac. or 53.5% of the entire land area was in farms, 257,395 in number, with an average size per farm of 68.2 ac. and an average value per acre of \$28.62. Of the farm area 8,199,039 ac.

or 47% was crop land; 4,105,166 ac. or 23%, pasture land; and 4,195,053 ac. or 24%, woodland. The total value of farm property was \$611,301,172, of which \$502,370,806 was represented by land and buildings; \$33,544,806, by implements and machinery; and \$75,385,560, by domestic animals.

According to the census of 1930 Alabama produced in 1929 field crops to the value of \$207,072,140, ranking sixteenth among the states. It stood fifth in cotton and fourth in cottonseed, third in sweet potatoes, sixth in watermelons, and fourth in figs, oranges and pecans. The chief crop was cotton, 1,312,963 bales grown on 3,566,498 ac. and valued at \$105,693,522, together with cottonseed, 629,410 tons, \$18,252,890. Other important crops were grains, \$42,844,023, chiefly corn 35,683,874 bu.; vegetables, \$21,501,234; hay, 333,657 tons, \$6,914,559, and fruits and nuts, \$3,678,963. Among the vegetables were sweet potatoes valued at \$5,941,357, potatoes \$2,333,811, watermelons \$602,501, and cucumbers \$314,985. The leading fruit and nut crops were peaches 505,278 bu., apples 437,478 bu., pears 224,921 bu., oranges 259,019 boxes, figs 1,189,758 lbs., strawberries 9,321,222 qts., and pecans 1,543,616 lbs. The state ranked first in sweet sorghum with 1,356,484 gals., and third in sugar-cane for sirup with 2,076,388 gals.

Farm products sold by cooperative marketing rose from \$837,498 in 1919 to \$3,863,460 in 1929. Farm machinery and equipment in 1930 included 73,634 automobiles, 12,838 motor trucks, 4,664 tractors, 972 electric motors, and 2,485 stationary gas engines.

**Animal Industry.** Mule-raising, in which Alabama ranks fifth among the states, and cattle-raising are the foremost livestock interests. According to the census of 1930 the state ranked twenty-seventh in total value, \$75,385,560, of domestic animals on farms. Among these were mules, 332,133 valued at \$32,368,755; horses 64,840, \$4,343,262; cattle, 799,473, \$27,690,488; swine, 831,171, \$6,293,171; sheep, 69,156, \$287,371, and goats, 44,780, \$91,252.

Of the cows on farms, 370,830 were kept mainly for milk production and 89,514 mainly for beef production. In 1929, 123,548,606 gals. of milk were produced; the total value of dairy products sold was \$8,378,760. The value of all poultry raised, chiefly chickens, was \$7,931,299; the chickens sold were valued at \$2,432,972. Of 34,564,672 doz. chicken eggs produced, valued at \$10,077,585, 16,881,049 doz., with a value of \$4,940,422, were marketed. Honey, amounting to 850,205 lbs. valued at \$146,204, was produced from 93,919 hives.

**Fisheries.** While the commercial fisheries of the state are not of great importance, the total catch for 1930 amounted to 10,070,000 lbs., valued at \$443,000. Among the more important salt water fish taken are mullet, snapper, drum, grouper and sea bass. The state operates a fish hatchery for which \$8,430 was spent in 1930. The output for the year was 163,000 bass and other game fish. The United States Bureau of Fisheries distributed 359,455 large-mouth bass, and 168,445 sunfish in various waters.

**Transportation.** Many millions of dollars have been spent in the development and improvement of Alabama's inland waterways. Due largely to the assistance of the Federal Government, the state now has about 2,000 mi. of navigable rivers. The Alabama River system, connecting the port of Mobile with the cities of Montgomery, Birmingham and Tuscaloosa, includes more than 1,000 mi. of this total. Competing successfully with the railroads, this system penetrates both a rich cotton-growing region and the important steel manufacturing center of Birmingham. Above Tuscaloosa, the BLACK WARRIOR RIVER, improved by the Federal Government in 1918, reaches into the coal and iron fields. The trans-shipment, at Mobile, of manganese ore from Brazil for use in the Birmingham district, and the development of an all-water freight rate from New York and Atlantic seaboard ports, via Mobile to the interior, help balance the flow of tonnage on the river system. In addition, the Tennessee River, navigable to Chattanooga, sweeps across the northern part of the state. Mobile, the only port of entry, has a fine system of docks and has become one of the most important ports on the Gulf of Mexico.

Practically every railroad trunk line in the south passes through Birmingham, including the Atlantic Coast Line, the Seaboard Air Line, the Louisville & Nashville and the Southern systems. In 1930 the total mileage of steam railways was 5,257. The total

crease in truck registrations from 23,193 in 1925 to 37,976 in 1930. During the same period, the number of buses increased from 693 to 2,379, or 244%.

**Manufactures.** The chief manufacturing industries have been developed through the utilization of the state's mineral, agricultural and forest resources, principally coal, iron ore, cotton and timber.

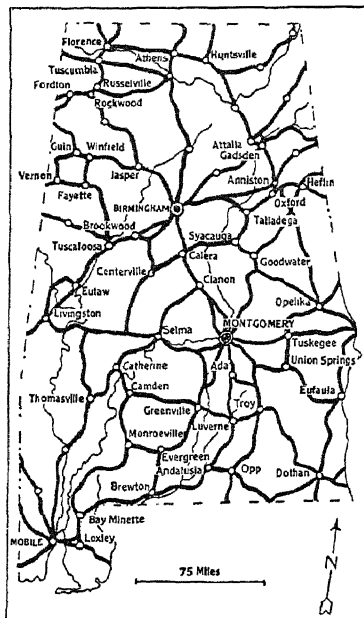
According to the Census of 1930 Alabama with manufactures for 1929 valued at \$560,378,132 stood twenty-fifth among the states, ranking first in cast iron pipe, fifth in cotton goods, sixth in coke and pig iron, and seventh in lumber. Its 2,848 establishments gave employment to 10,475 officers and employees, who received \$24,385,366 in salaries and to 119,559 wage earners, who were paid \$102,004,881 in wages. These factories used a total of 785,330 horse power, expended \$41,447,011 for fuel and power, and \$260,806,377 for material and supplies, and added by the process of manufacture \$258,124,744 to the value of their output.

The industries devoted to the manufacture of iron and steel and allied products, lumber and planing mill products, coke and cotton goods employed two-thirds of all persons engaged in the manufactories of the state, paid 71% of the salaries and wages, and produced 64% of the factory output of the state. Among the principal manufactures in the order of value were iron and steel, \$110,057,251, including rolling mill products, \$74,172,710, and blast furnace products, \$35,884,541; cotton goods, \$102,330,864; lumber and timber products, \$51,500,007; cast-iron pipe, \$37,208,672; coke, \$24,937,794; car construction and repairs in railroad shops, \$17,724,476; cottonseed oil, cake and meal, \$14,874,368; fertilizers, \$13,242,041; printing and publishing, \$12,595,319, and planing mill products, \$12,022,398.

Birmingham, the chief manufacturing center, owes its outstanding supremacy to abundant nearby supplies of coal and iron ore. Jefferson Co., in which the city is situated, produced an output valued at \$241,000,000, or 45% of the total manufactures of the state. To this total the city contributed an output of \$137,000,000. This district leads all others in the South in iron and steel production. From 1927 to 1929 Alabama rose from seventh to fifth rank in the production of cotton goods, being surpassed only by North Carolina, South Carolina, Massachusetts and Georgia. Among the smaller manufacturing cities, with value of output, are Montgomery, \$21,557,523; Mobile, \$19,302,245; Gadsden, \$12,245,551, and Anniston, \$10,849,193.

**Commerce.** According to the census of 1930, there were in 1929 1,743 wholesaling establishments in Alabama, with total sales of \$574,145,187. These organizations employed 13,733 men and women, whose salaries aggregated \$23,650,325. The chief wholesaling center is Birmingham, with Mobile and Montgomery also important.

The sales of the 21,432 retail stores amounted to \$524,472,335. Sales per store averaged \$24,471; sales per capita were \$198.19.



ALABAMA STATE ROADS

highway mileage was 86,312, of which 18,369 mi. were surfaced roads. The total highway expenditure during 1929 was \$28,009,717, of which \$18,271,180 was paid by the state, and \$9,738,537 by county and local governments. Motor vehicle registrations during 1930 were 277,146, compared with 194,580 in 1925. The growth of trucking facilities is indicated by the in-

## CHIEF RETAIL DISTRIBUTING GROUPS

<i>Group</i>	<i>No. of Stores</i>	<i>Sales</i>	<i>% of Total</i>
General Mdse.	5,415	\$172,759,915	32.93
Automotive	3,168	101,361,124	19.32
Foods	6,601	94,742,913	18.07
Apparel	741	27,442,783	5.24
Furn. & Household	672	25,539,856	4.87
All other stores	4,835	102,625,744	19.57
Total, all stores	21,432	\$524,472,335	100.00

Mobile, the principal port, handled water-borne commerce amounting to 4,713,683 tons, with a value of \$189,785,403. The extensive development of Alabama's inland waterways has helped Mobile attain its present importance as a Gulf port.

**Finance and Banking.** The state constitution of 1901 prohibited state borrowing for any purposes other than war, invasion, or rebellion. However, since 1922 several amendments have provided bond issues for highways and harbor improvements. The assessed value of all real and personal property in 1930 was \$1,244,143,572. The total funded debt was \$62,511,000. Total revenue receipts in 1928 were \$29,623,997; total expenditures \$44,679,281. The chief sources of income were property and special taxes, \$9,479,360; licenses, including motor vehicle taxes, \$11,256,740. The principal expenditures were for highways, \$18,023,156; permanent improvements, \$21,792,183; educational aid, \$6,713,598, and debt service, \$2,196,789.

There were 314 banks in Alabama in 1930, of which 96 were national banks, 215 trust companies or state banks, and 3 private banks. They had an aggregate capital of \$28,811,060; surplus and undivided profits totaled \$26,583,000. Their total resources were \$334,593,000; loans and discounts, including rediscounts, amounted to \$210,686,000. Demand and time deposits, including postal savings, aggregated \$227,788,000. Per capita demand and time deposits were \$85.96; per capita savings deposits, \$36.99. The total savings of \$98,030,000 were owned by 308,995 depositors. National bank circulation aggregated \$13,641,000.

**Government.** The law-making power is vested in a legislature composed of a senate of 35 members and a house of representatives of 106 members meeting in quadrennial sessions limited in length to 50 days. Both senators and representatives are elected for four-year terms. The chief executive is the governor, elected for a term of four years but ineligible for re-election; he receives an annual salary of \$7,500. While the governor is endowed with veto power, a majority vote of each house is sufficient to override his veto. The supreme court consists of seven judges elected for terms of six years at salaries of \$6,500 per annum.

**Social Welfare Institutions.** At Birmingham an industrial school for white girls and at East Lake, Birmingham, one for white boys are maintained by the state. The Jefferson Manley Faulkner Soldiers' Home is at Mountain Creek, an institution for the

deaf at Talladega, a hospital for white insane at Tuscaloosa and for colored at Mt. Vernon. Wetumpka has a tuberculosis hospital. At Montgomery is the Reform School for Juvenile Negro Law Breakers. The state prisons are at Wetumpka, Speigner and Montgomery.

**Education.** The first school was established at Boat House, on the Tenas River, in 1810. This was followed by an academy at St. Stephens in 1811, and one at Huntsville the following year. In 1826, the first public school system in the state was begun at Mobile; and a similar system was extended to the whole state in 1854. School attendance laws effective since 1917 require children from 8 to 15 years of age to attend school at least 80 days of the year. The public elementary schools in 1929 had 17,412 teachers and 638,358 pupils; the high schools, 4,603 teachers and 123,221 pupils. School buildings for whites numbered 3,806; for Negroes, 2,292.

The number of persons from 5 to 20 years of age attending school in 1930 was 610,529, or 62% of the population within the ages specified, as compared with 522,758, or 57.7% in 1920. The number of illiterates ten years and over in 1930 was 251,095, or 12.6% of the population. In 1920 there were 278,082 illiterates or 16.1%. Native white illiterates numbered 60,957, or 4.8% of that group in 1930; and 65,394, or 6.3% in 1920. Negro illiterates in 1930 numbered 188,673, or 26.2% of the Negro population, a noticeable decrease from the 210,690 Negro illiterates, 31.3% in 1920.

The principal state institutions of higher learning include the University of Alabama at University, the Alabama Polytechnic Institute at Auburn, and Alabama College at Montevallo. Important private institutions are the Birmingham Southern College at Birmingham, the Woman's College of Alabama at Montgomery, HOWARD COLLEGE at Birmingham, and for Negroes, the Tuskegee Normal and Industrial Institute at Tuskegee, and Talladega College at Talladega. There are state normal schools at Daphne, Florence, Jacksonville, Livingston, and Troy, and one for Negroes at Montgomery. The Division of Library Extension, under the State Department, is located at Montgomery.

**Population.** In 1930 Alabama ranked fifteenth among the states with a population of 2,646,248 or an average of 51.6 per square mile, an increase of 298,074, or 12.7% over 1920. The population rose from 127,901 in 1820 to 964,201 in 1860, 1,828,697 in 1900, 2,138,093 in 1910 and to 2,348,174 in 1920. In 1930 there were 1,700,775 or 64.3% whites, and 944,834 or 35.7% Negroes, an increase from 1920 of 16.4% whites and 4.9% Negroes. Of the whites 1,684,065 were native born and 15,710, foreign born. The rural population was 1,901,975, or 71.9% of the total, an increase of 63,118 or 3.4% from 1920; the urban population was 744,273 or 28.1% of the whole, an increase of 234,956 or 46.1% since 1920. There were in 1930 seven cities with a population of 20,000 and upwards: Birmingham, 259,678; Mobile, 68,202; Mont-

gomery, 66,079; Gadsden, 24,042; Anniston, 22,345; Bessemer, 20,721; Tuscaloosa, 20,659.

**Occupations.** In 1930 1,026,295 persons, or 38.8% of the population, were gainful workers 10 years old or older; 75.2% of these were males and 24.8% were females; 57% were native white; 0.9% foreign-born white, and 42.1% Negro. In agriculture, the principal occupation, 492,761 persons were engaged; of these 252,260 were farmers and 80,103 farm wage workers. Among other important occupations, with number of workers, were manufacturing, 185,681, including 100,531 factory operatives and laborers of which 26,616 were engaged in cotton mills and 17,789 in saw and planing mills; domestic and personal service, 102,345; trade, 73,568, including 21,878 retail dealers and 23,895 salespersons; transportation and communication, 55,163, including 12,366 chauffeurs; professional service, 39,657, of which 17,497 were school teachers, 3,057 men and 14,440 women; mining, 31,415, and clerical service, 31,321.

### HISTORY

The region that is now Alabama was first seen by white men in 1539 when FERNANDO DE SOTO discovered it on his exploring expedition westward from Florida. He fought a fierce battle with Indians near the head of Mobile Bay, claimed the country for Spain and pushed on. Afterward England laid claim to the territory north of the Gulf, and asserted rights of trade with the Indians. Because of the discoveries of MARQUETTE, JOLIET and LA SALLE, France in 1678 claimed the same region. The first white settlement in what is now Alabama was made by the French in 1702, when Bienville built Fort Condé, on the Mobile River a few miles north of the Bay, and established a colony there. But in 1711 this settlement was moved permanently to the site of the present city of Mobile, and until 1722 was the capital of the Province of Louisiana. The colony languished until the importation of Negro slaves in 1721, after which it prospered. After France ceded Alabama to Great Britain in 1763, there began years of controversy between England, Spain and the United States over its ownership. The occupation by the United States military forces in 1813 brought the whole of the present state under Federal jurisdiction. During the war of 1812 the Indian tribes were inflamed against the Americans by Indian allies of the British, who furnished them with arms and ammunition, and at Fort Mims the Creeks massacred five hundred persons. The Indians were subdued by Gen. ANDREW JACKSON, who broke the power of the Creek Confederacy. (See also CREEK WAR.) Cessions by the Creeks and other tribes gave most of the present state to white ownership, under which the Indian lands were formed into counties and rapidly occupied by settlers. At first a part of the Mississippi Territory, in 1817 the eastern half was organized as Alabama Territory with Cahaba as its capital. On Dec. 14, 1819, Alabama was admitted to statehood. The capital was at Tuscaloosa, 1826-46, when it was moved to Montgomery. The

population, not including Indians, was 127,900 by the 1820 census.

The question of slavery and its protection by the national Government was vital in Alabama from the beginning. After many years of hot discussion and political maneuvering, William L. Yancey, a leader in the STATES RIGHTS party which accepted the theories of JOHN CALHOUN, induced the adoption by a Democratic state convention in 1848 of the "Alabama Platform," which denied to the national Government the right to interfere with slavery in a territory. The question continued to be sharply contested, but after the election of Pres. Lincoln political opinion solidified. On Jan. 11, 1861, an ordinance of secession was adopted, and on Feb. 4 Montgomery became the capital of the Confederacy. The state contributed about 120,000 men to the Confederate army. The Union forces gained a foothold in the Tennessee valley in 1862; in 1864 the Confederate forts and ships at Mobile were captured by Farragut; and the whole state was occupied in April, 1865. Reconstruction brought troublous times: the General Assembly refused to ratify the 14th amendment; the state senators and representatives in Congress were denied seats; and in 1867 state government was abolished and military rule instituted. CARPET BAGGERS and Negroes gained the upper hand; many whites were disfranchised; and there followed a period of extravagance and corruption which bankrupted the state and plunged it into social, political and economic chaos. It was readmitted to the Union in 1868. During the next five or six years the better element regained control, and the inflow of capital for the development of valuable deposits of coal, iron ore and limestone and of manufactures brought peace and security to many citizens. Dissatisfaction among the farmers in the early 1890's led to the formation of a POPULIST PARTY which was active in state politics for several years. In 1901 a new constitution was adopted which practically eliminated the Negro vote.

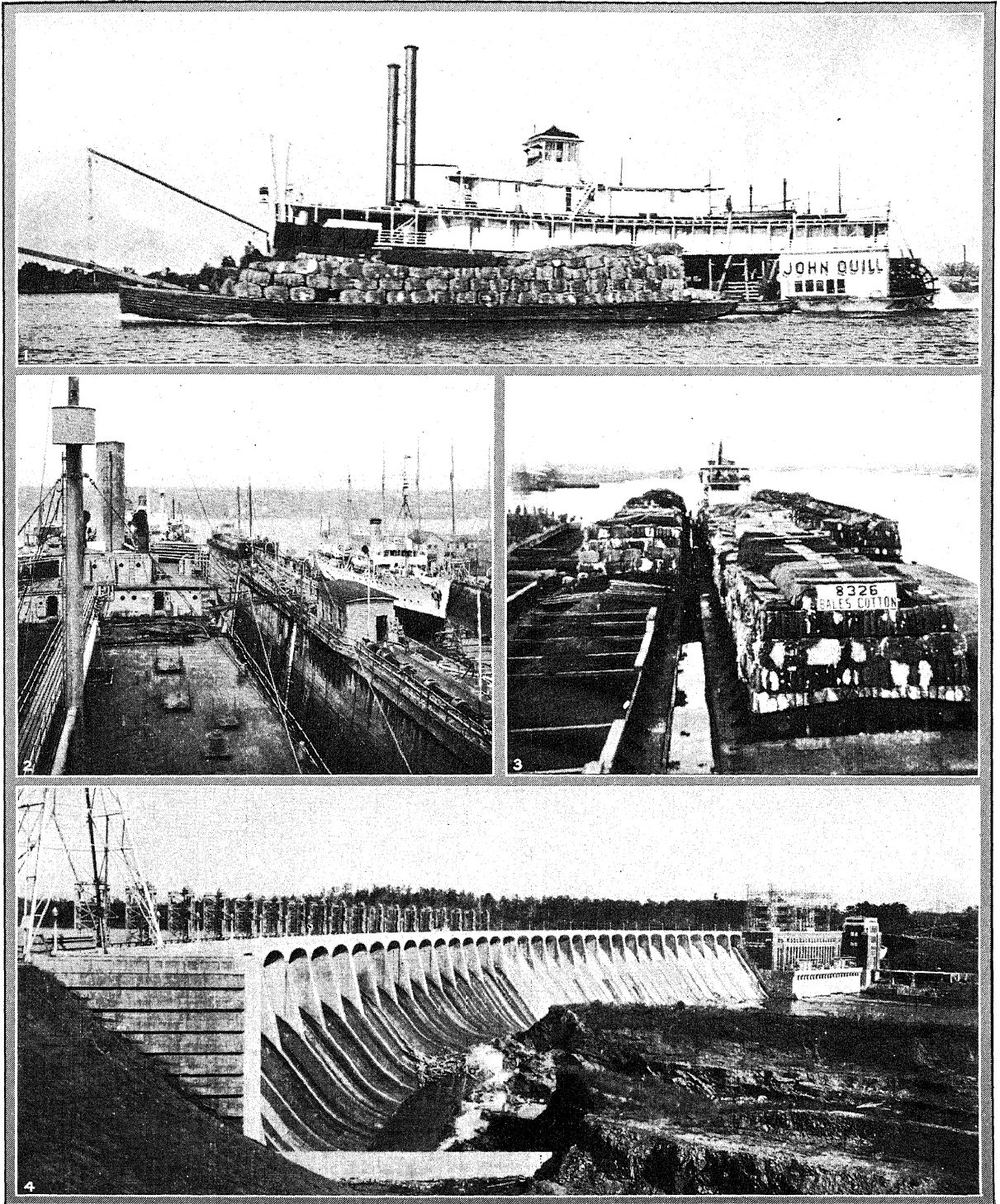
After the World War the state was greatly interested in the disposition of the Muscle Shoals nitrate fixation plant built by the Federal Government.

Alabama has been consistently Democratic in politics, and in the 1932 election gave its electoral votes to Franklin D. Roosevelt. Hugo L. Black was reelected to the Senate.

**BIBLIOGRAPHY.**—J. A. Pickett, *A History of Alabama*, 1851; T. M. Owen, *History of Alabama and Dictionary of Alabama Biography*, 4 vols., 1921.

**ALABAMA, UNIVERSITY OF**, at Tuscaloosa, Ala., a coeducational, state-controlled institution, founded Apr. 12, 1831. The movement for the establishment of the university began in 1819 when Congress donated 72 sections of land for the "endowment of a seminary of learning." In Apr. 1865, during the Civil War, all buildings of the university were fired by Federal troops. Rebuilding was begun in 1867 and instruction resumed in 1869. The university has productive funds amounting to \$2,750,000. The library contains 60,000 volumes. In 1931-32 there

## ALABAMA



1, 2, 3, COURTESY MOBILE C. OF C.; 4, BIRMINGHAM C. OF C.

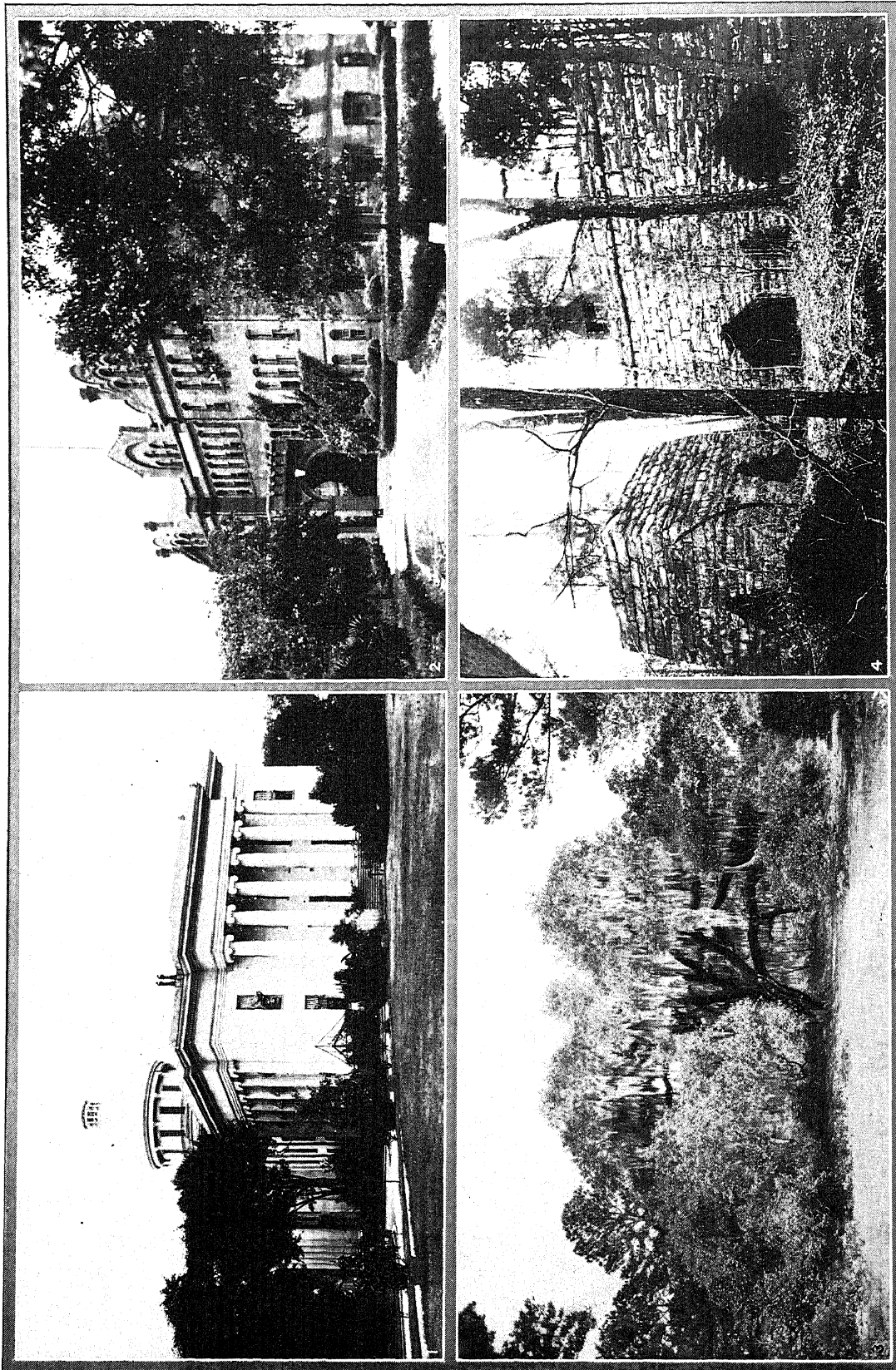
### THE BUSY RIVERS OF ALABAMA

1. A packet boat transporting cotton down the Alabama River to Mobile. 2. The shipyards at Mobile: a nerve center of the cotton traffic. 3. Federal barges bound for Mobile with their cargoes of cotton. The important Tombigbee-Warrior rivers have been canalized by the Government, affording year-

around transportation between Mobile and Birmingham. 4. The Jordon Dam Development on the Coosa River, as seen from the west bank. The dam is 1,680 ft. long, with a 93 ft. head, and will have an ultimate installation of 220,200 horsepower.



# ALABAMA



1. COURTESY MONTGOMERY C. OF C., PHOTO BY STANLEY PAULGER; 2. PHOTO FROM TUSKEGEE INSTITUTE; 3. COURTESY MOBILE C. OF C., PHOTO BY MC GILL STUDIO; 4. BIRMINGHAM C. OF C.

## LANDMARKS OF ALABAMA

1. State Capitol at Montgomery.
2. Milbank Agricultural Building at Tuskegee Institute.
3. Jackson's Oak, under which Andrew Jackson is said to have camped in 1814.
4. Old Tannehill furnace in Birmingham, constructed in 1847.





# ALABAMA

Area, 51,998 sq. m.  
Pop. 2,646,248.

## PRINCIPAL CITIES

Pop.—Thousands  
1 Abbeville M 22  
2 Acton G 13  
3 Alabama City D 17  
4 Albertville C 16  
5 Alexander City D 17  
6 Andalusia N 15  
7 Anniston M 16  
8 Athens A 12  
9 Attmore O 8  
10 Attalla D 17  
11 Auburn J 21  
12 Bay Minette P 7  
13 Bessemer G 12  
260 Birmingham F 13

1 Blossburg F 12  
2 Boaz D 17  
1 Brantley M 16  
3 Brewton O 11  
4 Bridgeport A 10  
5 Brierfield H 12  
6 Brighton G 12  
7 Carbon Hill E 9  
8 Clanton I 14  
9 Clayton L 21  
10 Cordova E 11  
11 Cullman D 13  
12 Dadeville I 19  
13 Decatur J 12  
14 Demopolis J 12  
15 Dothan O 21  
16 E. Brewton O 11  
17 E. Tallapoosa F 18  
18 Elba N 17  
19 Enterprise N 18  
20 Eufaula L 23  
21 Eutaw I 16  
22 Evergreen N 12  
23 Fairbairn I 23  
24 Fairfield F 12  
25 Fairhope M 13  
26 Fayette F 12  
27 Fivepoints H 22  
28 Florida O 16  
29 Florence A 8  
30 Ft. Deposit L 14  
31 Fort Payne C 19  
32 Frisco City N 9  
33 Gadsden D 13  
34 Geneva O 15  
35 Georgiana M 15  
36 Grapeland M 15  
37 Greensboro F 12  
38 Greenville L 14  
39 Guin D 6  
40 Guntersville C 16

1 Haleyville D 8  
2 Hartford O 19  
3 Hartselle C 12  
4 Headland N 22  
5 Hefflin F 20  
6 Huntsville P 20  
7 Ironville F 12  
8 Jackson N 6  
9 Jacksonville E 19  
10 Jasper E 10  
11 Lafayette I 21  
12 Lanett I 22  
13 Leeds F 14  
14 Lineville G 19  
15 Lipscomb G 12  
16 Livingston J 5  
17 Laverne M 13  
18 Marion H 10  
19 Mignon H 16  
20 Mobile Q 5  
21 Montgomery Q 5

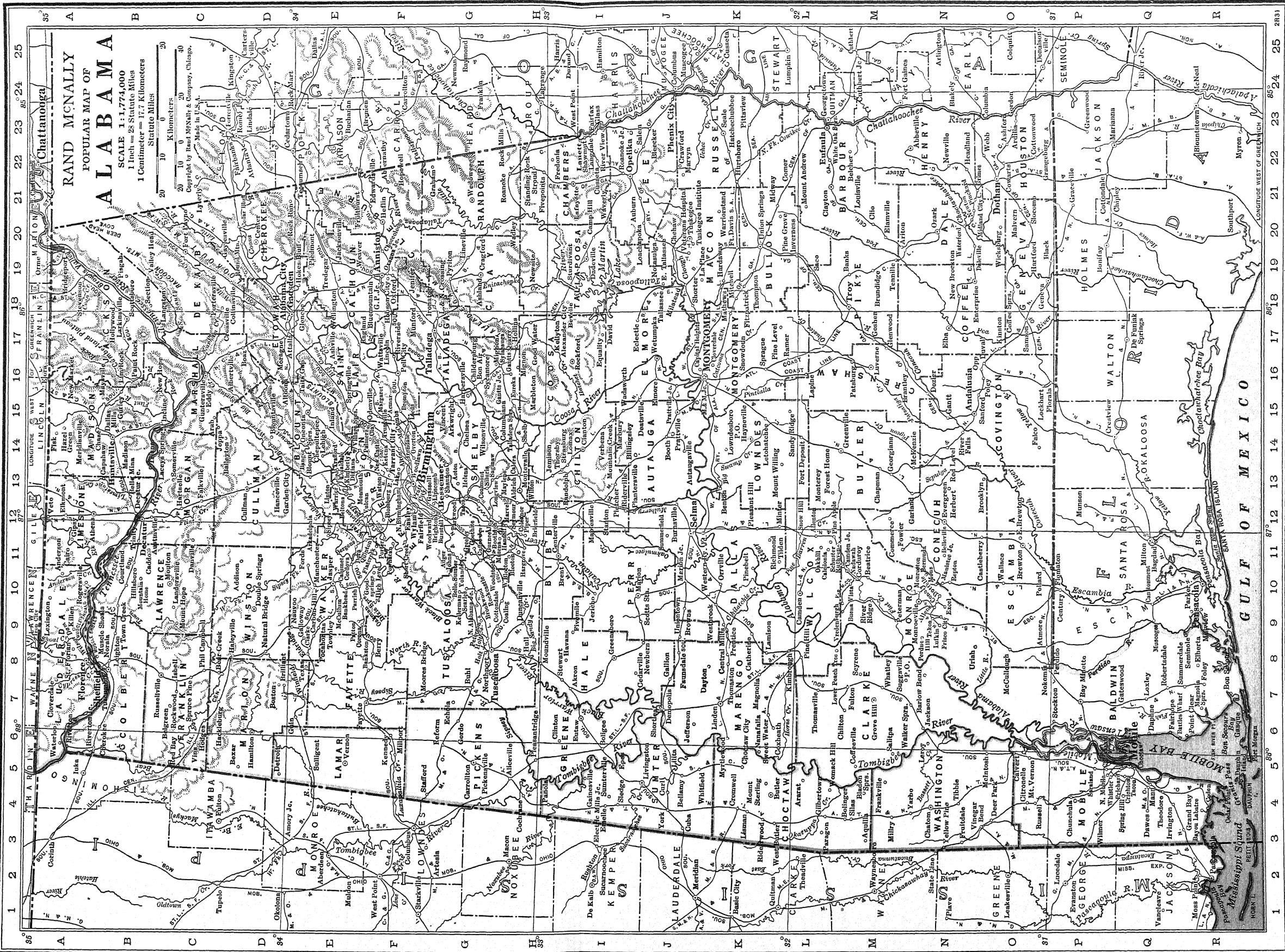
2 Northport G 8  
3 Opelika I 21  
4 Opp N 16  
5 Ozark N 20  
6 Phenix City J 24  
7 Piedmont E 20  
8 Prattville J 15  
9 Prichard P 5  
10 Roanoke H 21  
11 Russellville B 8  
12 Samson O 17  
13 Scottsboro B 17  
14 Selma J 12  
15 Sheffield B 8  
16 Sylacauga G 16  
17 Talladega P 17  
18 Tarrant City F 13  
19 Thomasville L 7  
20 Troy M 18  
21 Tuscaloosa G 8  
22 Tusculum B 8  
23 Tuskegee J 20  
24 Union Springs K 19  
25 Wetumpka J 16  
26 York J 4

## RAND McNALLY POPULAR MAP OF ALABAMA

SCALE 1:1,774,000  
1 Inch = 25 Statute Miles  
1 Centimeter = 17.7 Kilometers

Statute Miles  
0 10 20  
Kilometers  
0 10 20

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GULF OF MEXICO



was a student enrollment of 4,375, and a faculty of 185 headed by Pres. George Hutcheson Denny.

**ALABAMA and KEARSARGE**, two warships which engaged in a notable encounter in the Civil War on June 19, 1864. The British-built Confederate cruiser, *Alabama* (see **ALABAMA CLAIMS**), under command of Capt. Semmes, in the summer of 1864 returned to the English channel and put into Cherbourg for supplies. The Federal vessel *Kearsarge*, under command of Capt. Winslow, appeared under steam outside the port without entering or anchoring, an act which Semmes accepted as a challenge. The two ships met about seven miles off the Cherbourg coast, outside French jurisdiction; a French ironclad remained near to keep peace within the marine league. The *Kearsarge* forced the *Alabama* into a circling track and held the enemy close, firing steadily; the fire from the *Alabama* was furious but ill-directed. Beginning the seventh rotation, the *Alabama* attempted to turn back to Cherbourg, thereby presenting her port broadside. Winslow directed a raking fire which halted the maneuver and so overwhelmed the crew of the *Alabama* that in a few minutes the Confederate ship struck colors. Semmes and his crew had taken to small boats when the shattered *Alabama* sank.

**ALABAMA CITY**, an industrial city in Etowah Co., northeastern Alabama, near the Coosa River, just northwest of Gadsden. Bus lines and three railroads afford transportation. Coal and iron mining are the chief interests of the vicinity. The city has cotton, lumber and large steel mills. Alabama City was incorporated in 1890; chartered in 1891. Pop. 1920, 5,432; 1930, 8,544.

**ALABAMA CLAIMS**, demands for indemnity pressed by the United States against Great Britain for damages sustained as a result of Great Britain's failure to observe the obligations imposed by international law upon neutral nations as to their relations with belligerents. The *Alabama*, a confederate vessel built in England after the Civil War had begun, captured and destroyed about 70 American vessels before its destruction (see **ALABAMA; KEARSARGE**); the *Florida*, *Shenandoah*, *Georgia* and other Confederate ships of war were similarly built or serviced by Great Britain. The **TREATY OF WASHINGTON**, 1871, stipulated that the Alabama claims, as the collective claims for damages were generally called, be submitted to a tribunal of arbitration. This tribunal, consisting of five commissioners, CHARLES FRANCIS ADAMS for the United States, Sir Alexander Cockburn for Great Britain, and three from disinterested nations, met at Geneva, Dec. 15, 1871-Sept. 14, 1872. Its decision denied the claims of the United States for indirect, or national, damages, but recognized certain claims for direct, or individual, damages, for acts committed by the *Alabama*, the *Florida* and the *Shenandoah*. The lump sum of \$15,500,000 was assessed against Great Britain by the tribunal to satisfy these claims. The United States received the money in the following year and distributed it to the individual claim-

ants by means of a special claims court created by act of Congress. The most important result of this adjudication was in strengthening the principle of arbitration of international disputes.

**ALABAMA POLYTECHNIC INSTITUTE**, at Auburn, Ala., is the oldest land-grant college in the South, and the second oldest in the country. It was established in 1872 under the provisions of the Federal Land Grant Act, and was first known as the Alabama State Agricultural and Mechanical College. The institute, which is coeducational, is supported by the state and Federal Government. It comprises colleges of Engineering and Architecture, Agriculture, Academic Faculty, and Veterinary Medicine; schools of Education and Chemistry and Pharmacy, a Department of Home Economics and an Extension Division. The library contains 61,040 volumes. In 1931-32 there were 1,890 students and a faculty of 168, headed by Pres. Bradford Knapp.

**ALABAMA RIVER**, a stream draining southwestern Alabama, formed by the confluence of the Coosa and Tallapoosa rivers at the southern border of Elmore Co., about 10 mi. northeast of Montgomery. The river flows westward as far as Selma, from which point it takes a southwesterly direction and unites with the Tombigbee River about 33 mi. north of Mobile to form the Mobile River. Because of its uneven course the Alabama has a length of nearly 350 mi. It is navigable by steamboats as far as Montgomery and is a useful channel of transportation for the cotton-growing region through which it flows. Its chief tributary is the Cahaba which joins it just below Selma.

**ALABASTER**, a pure, fine-grained variety of GYPSUM, commonly white, translucent and slightly glistening. Chemically it is the sulphate of calcium with two molecules of water of crystallization. It is soft and easily carved, and is in consequence used to make statuettes, ornaments and carved boxes which are often attractive because of their translucence and velvety whiteness. Since gypsum is soluble in water such objects cannot be exposed to the weather as they would rapidly become pitted and opaque. Gypsum was probably deposited from evaporating, landlocked water basins, such as the modern Salton Sink or the Great Salt Lake. Such deposits of alabaster are known in Nova Scotia, and in New York, Ohio and other States. In Italy alabaster from Castelino is carved in Florence.

The name is derived from the word *alabastrites* or alabaster stone, which ancient writers applied to the material from which ointment vases or "alabasters" were made. They usually meant, however, the stalagmitic and stalactitic variety of CALCITE which is found covering the walls, roofs and floors of certain caverns. They did not seem to distinguish between this and gypsum alabaster. The calcite variety has also been called Oriental alabaster and Egyptian alabaster, due to its occurrence near Thebes. It is harder than gypseous alabaster and much used for ornaments. See also STALAGMITE.

**ALADDIN**, one of the most celebrated characters in the *Arabian Nights*. He became the possessor of a marvelous lamp and ring to which were attached two genii, who, appearing whenever he rubbed the lamp or ring, performed astonishing feats by their magic.

**ALAIN DE LILLE**. See LILLE, ALAIN DE.

**ALAIS**. See ALÈS.

**ALAMAN, LUCAS** (1792-1853), Mexican statesman and historian, born in Guanajuato. Educated first in the classics and later in chemistry in the School of Mines of Mexico, he went abroad in 1814 to travel and study, visiting Spain, France and other countries. The liberal ideas with which he came in contact made him an advocate of the independence of Mexico. He was sent again to Spain in 1819, this time as a deputy for his native state, and there worked for the pacific separation of Mexico from Spain and helped in the preparation of a project for independence. After Mexico became independent he went to Paris and London to form a company for the exploitation of the mineral wealth of Mexico. For a time he was secretary of interior and minister of state. In 1829 Alaman became temporarily, with Quintanar and Velez, head of the Republic. Later he was accused of permitting the capture and shooting of several patriots, but was absolved. The incident practically terminated his political career, however, and henceforward he devoted his time to the study and writing of history. His most important works are *Disertaciones históricas* (5 vol., 1844) and *Historia de Mejico desde la época colonial hasta nuestros días* (5 vol., 1849.)

**ALAMANCE, BATTLE OF**, May 16, 1771, the culmination of the Regulators' uprising in western North Carolina. (See REGULATION, NORTH CAROLINA.) A force of 300 militia, part of an army of about 1,300 raised to repress the outbreak, was beleaguered in Salisbury. Gov. Tryon, heading the main body of the troops, marched to the division's relief. West of Alamance Creek he encountered about 2,000 Regulators, poorly armed and without military organization. They refused to disperse without assurance that Tryon would "punish according to their deserts the original defenders," the officers whose malfeasance had prompted the uprising; and a sharp battle ensued for two hours. Without a higher officer than captain among the Regulators, each company attempted to fight independently. The really effective fire returned against the militia was that of lone sharpshooters. The Regulators were routed with a loss of nine killed and "a great number" wounded; the militia lost nine killed and about 60 wounded. On June 19 Tryon executed six prisoners.

**ALAMANNI, LUIGI** (1495-1556), Italian poet and writer of hymns, satires and elegies, was born at Florence in 1495. Through SIR THOMAS WYATT, who imitated his style, he exerted considerable influence on English poetry. His most notable work is the didactic poem, *La Coltivazione*. The poet conspired against Giulio de' Medici and fled to Venice, thence to Genoa and later became a resident of

France. Alamanni died at Amboise, France, Apr. 18, 1556.

**ALAMANNI**, a name covering apparently a combination of lesser Germanic tribes having their home east of the upper Rhine. In 213 A.D. they attacked Rhaetia, but were repulsed. In 260 they invaded Italy, where Gallienus defeated them at Milan. Aurelian drove them back from Italy and Rhaetia. Julian inflicted a decisive defeat upon them at Strasbourg in 357, driving them back across the Rhine whence they returned some years later to annoy Valentinian I. Early in the fifth century they settled in Alsace and Switzerland. In 495 they were conquered by Clovis and their territories added to his dominions.

**ALAMEDA**, a city in Alameda Co., western California, situated on an artificial island in San Francisco Bay, 3 mi. from San Francisco. Three bridges and a tube constructed under the tidal canal connect Alameda with Oakland. Steamships, electric trains, buses, ferries, and air ferries, an industrial belt line and the Southern Pacific Railroad afford transportation. There are two airports. Alameda is essentially a residential community. However, it has shipyards, lumber mills, fish-packing houses and factories making pumps, engines, boats, glassware, tiles, pencils and various other commodities. In 1929 the manufactured output was worth about \$6,000,000; the retail trade amounted to \$9,418,753. The city has extensive wharves and warehouses; the harbor is the winter refuge of a large fishing fleet. Located in Alameda is a United States Army Air Supply Base. The first settlers came here during the Spanish régime. The town was incorporated in 1854, becoming a city in 1885. Pop. 1920, 28,806; 1930, 35,033.

**ALAMO, SIEGE OF**, Feb. 23-Mar. 6, 1836, a notable event of the Texan War for Independence. A small company of Texans and Americans under Col. W. B. Travis occupying the Alamo, an old Franciscan mission at San Antonio, were besieged by a Mexican force under Gen. Santa Anna. An almost continual bombardment was comparatively ineffective because of the thick walls of the mission. Having made a small breach in the walls, the Mexican troops attacked the fortifications on the morning of Mar. 6, gained ingress after heavy casualties, and in a desperate hand-to-hand conflict killed all but five of the Texans; these five were captured and forthwith shot. The Mexican loss was about 500; all in the garrison of 180, except three women and three children, were killed. The massacre excited horror and indignation in Texas and the United States. "Remember the Alamo!" became the rallying slogan of the Texans.

**ALAMOSA**, a city in southern Colorado, the county seat of Alamosa Co., is situated on the Rio Grande River, 130 mi. southwest of Pueblo. It is served by the Denver and Rio Grande Western Railroad. Gold, silver and lead are mined in this region. The district produces yellow pine timber, potatoes, sugar beets and small grain. Alamosa is the seat of the Adams State Teachers College. The city is a popular resort in a country famous for good fishing

and hunting. San Isabel National Forest lies on the east and Rio Grande National Forest on the west. Pop. 1920, 3,171; 1930, 5,107.

**ÅLAND ISLANDS**, an archipelago lying between Finland and Sweden in the Baltic Sea at the entrance of the Gulf of Bothnia. The group comprise the Finnish province of Åland (Ahvenanmaa). The islands, which number nearly 300, of which only 80 are inhabited, have an area of about 565 sq. mi. and a population of 27,093, consisting mainly of fishermen of Swedish extraction. Except for those which are rocky islets, the islands have a sandy surface. Cattle-raising, fishing and some agriculture are the chief occupations. The principal urban center is the town of Mariehamn, on the island of Åland.

*Åland Affair.* In 1809, the Åland group, long a possession of Sweden, was ceded with Finland to Russia.

Following the 1917 declaration of Finnish independence from Russia, the Åland inhabitants declared their right to self-determination and expressed a desire for union with Sweden. In 1920 Finland granted autonomy to Åland, and sent troops to quell the secessionist disorders. The League of Nations undertook to examine both sides of the controversy. A League commission sent to the islands submitted a plan providing for Åland autonomy under the continued sovereignty of Finland, and for the demilitarization of the islands. An agreement accepting this solution of the Åland Affair was signed by the Governments interested on Oct. 20, 1921, at Geneva.

**ALARCÓN, HERNANDO DE** (c. 16th century), first of the early Spanish navigators to visit the coast of California. He sailed in May, 1540, to join the expedition of de Coronado but did not find him. By penetrating the Gulf of California, he proved that Lower California was not an island, and made a map of that territory which differs little from the maps of to-day.

**ALARCON Y MENDOZA, JUAN RUIZ DE** (1588-1639), Spanish dramatist and poet, was born at Tasco, Mexico, about 1588. Alarcon was especially eminent in the heroic drama. He was graduated as doctor of laws in Mexico in 1606. Later he went to Spain and in 1628 began to produce dramatic works. Although widely criticized by contemporary poets, some of his comedies are regarded as the finest in the Spanish language. He died at Cordova, Spain, Aug. 4, 1639.

**ALARIC I** (c. 370-410), King of Visigoths. Prior to his becoming king, he commanded a Goth army under the Emperor Theodosius. Alaric invaded Italy in 402-3, threatened Rome, but later withdrew as the Romans proposed terms that were agreeable to him. However, the terms were not kept, with the result that he attacked and took Rome in 410. Alaric died soon after capturing Rome.

**ALASKA**, a territory of the United States, situated at the northwestern extremity of North America and bounded on the north by the Arctic Ocean, on the south and southwest by the Gulf of Alaska and the

Pacific Ocean, on the east by Yukon Territory and British Columbia and on the west by the Arctic Ocean, Bering Strait and Bering Sea. The area is 590,884 sq. mi., including the adjacent islands. The chief of these are the Alexander archipelago, about 1,100 islands lying at the southeastern extremity of the territory; the Kodiak and Aleutian Islands in the southwest; and the Pribilof Islands in the Bering Sea, which are breeding places for the fur seal.

Alaska may be divided into three broad geographic regions, which present striking contrasts in surface, climate, vegetation, mineral resources and agricultural possibilities. These regions may be designated as the Pacific mountain region, the central plateau region, and the Arctic plains region.

**The Pacific Mountain Region.** This is a continuation of the rugged mountainous district of the United States and British Columbia. It is a region of high relief and of great valleys, and extends approximately 1,200 mi. along the coast and about 200 mi. inland. Numerous snow-capped peaks rise to high altitudes; Mount McKinley in the Alaska Ranges, rises to a height of 20,300 ft. Scores of large glaciers descend to the coast from the extensive snow and ice fields. The summers are cool and damp and the winters mild. Precipitation is very heavy, ranging from 50 to 120 in. annually. On the higher slopes the snowfall also is heavy. Contrary to popular belief, the mean winter temperatures of Sitka, Juneau and St. Louis, Mo., are nearly the same. Seventeen of the 25 weather bureau stations on the Pacific coast of Alaska have never recorded temperatures lower than the St. Louis minimum of 22° below zero. The lower mountain slopes are heavily forested with hemlock, spruce and cedar. Most of the best timber is included in the federal reserves. Fish, minerals and trees are the principal economic assets of the region. Except in favored localities agriculture is not successful, as the arable land is limited and the summer weather is unfavorable.

**The Central Plateau.** This region of about 200,000 sq. mi. is of relatively low relief, characterized by flat-topped highlands, which are separated by broad valleys and lowlands except along the Bering Sea section, where broad lowlands, broken by low and rounded hills, constitute the landscape. On the central plateau lie the basins of the Yukon and Kuskokwim rivers. This is a country of short, warm summers with 18 to 20 hours of sunshine daily, and long and cold winters. There is a scant precipitation of from 9 to 19 in., with very little snowfall. The region contains most of the agricultural lands of Alaska and is rich in minerals. About two-thirds of the area is forest of the woodland or small open-growth type. Highly valuable pastures, offering opportunities for the grazing of reindeer, occur over much of the area. The mountains of the central plateau have in general an east-west trend, and are part of the great mountain region that extends to the international boundary. To this major highland area the name Brooks Range has recently been given in



honor of the late Dr. A. H. Brooks, the explorer, who did much to make Alaska understood and appreciated. Brooks range consists of smaller mountain groups, and is about 150 mi. wide. Its highest peaks rise to elevations of 8,000 ft. or more, and its crest averages 5,000 to 6,000 ft. above sea level.

**Arctic Plains Region.** The northern region, separated from the central portion by the Brooks Range, contains about a sixth of the territory of Alaska and may be truly called Arctic Alaska. It is a district of low, rolling relief, a slightly elevated plateau dissected by northward flowing streams. Its climate is of the true arctic type, with only about 6 or 8 in. precipitation. The winters are long and cold, the summers cool. Summer and winter extremes of  $66^{\circ}$  and  $-54^{\circ}$  respectively have been recorded. The long period of continuous sunshine, extending through weeks except when the sky is obscured by clouds, produces a luxuriant growth of mosses, flowers, lichens and grasses over much of the area, though the soil cover thaws to a depth of only a foot or sometimes less before the return of winter. The mineral resources of the region are small; coal and petroleum, however, are present. Probably the pasturage offered reindeer or muskox is the section's greatest asset. Timber becomes thin and low towards the Arctic Circle, and willows only a few inches long are to be found in the Arctic drainage basin.

**Forestry.** The extensive forests of the Pacific mountain region contain about 75,000,000,000 board ft. of timber suitable for pulp and lumber. The annual cut is about 50,000,000 board ft., a large part of which is made into cases for shipping salmon. In the central plateau region not more than half of the forested area bears timber suitable for commercial purposes; and this fraction can be used only for local uses until transportation is provided. The principal species of trees are white and black spruce, white birch, black cottonwood, aspen and tamarack. Compared with those of the Pacific region, the forests on the plateau are mere scrubs, varying in cordage from almost nothing in the stunted black spruce areas to 20 to 30 cords per acre in the birch and aspen sections, and several thousand board ft. per acre in the best white spruce areas.

The Tongass National Forest covering the panhandle, or southeastern section of Alaska, has more than 10,000 mi. of shore line, whose steep slopes are almost uniformly covered with dense forests of hemlock and spruce. This forest has been divided into pulp timber allotments. Each contains about a million acres grouped around those water-power sites most logically situated for the manufacture of paper. Through the joint action of the Forest Service and the Federal Power Commission, water power and timber are offered to the paper manufacturer who submits the most advantageous terms, the timber in quantities sufficient to supply the manufacturing capacity of the power site for a period of 50 years. Power is obtained under a federal license, also running for 50 years.

**Agriculture.** That agriculture and grazing are possible in Alaska has been demonstrated, crops and livestock having been produced there by white men for more than a century. Though the agricultural resources are almost wholly undeveloped, crops of wheat, rye, oats, barley, hay, potatoes and hardy vegetables are produced for local consumption. The present crop production is limited by transportation difficulties and lack of markets rather than by climate and soil. Estimates of Alaska's arable and grazing lands vary from 65,000 to 100,000 sq. mi., probably half of which is suitable for cultivation. These estimates are exclusive of the reindeer pastures. Most of the cultivable land is in the central plateau region which climatically is best suited to the growth of crops. The grazing season for cattle and sheep is only about 100 days, and the eight to nine months of indoor feeding necessary is a handicap to livestock production. The soils of Alaska are of moderate fertility; only in the immediate vicinity of the streams, however, can they be called rich and deep.

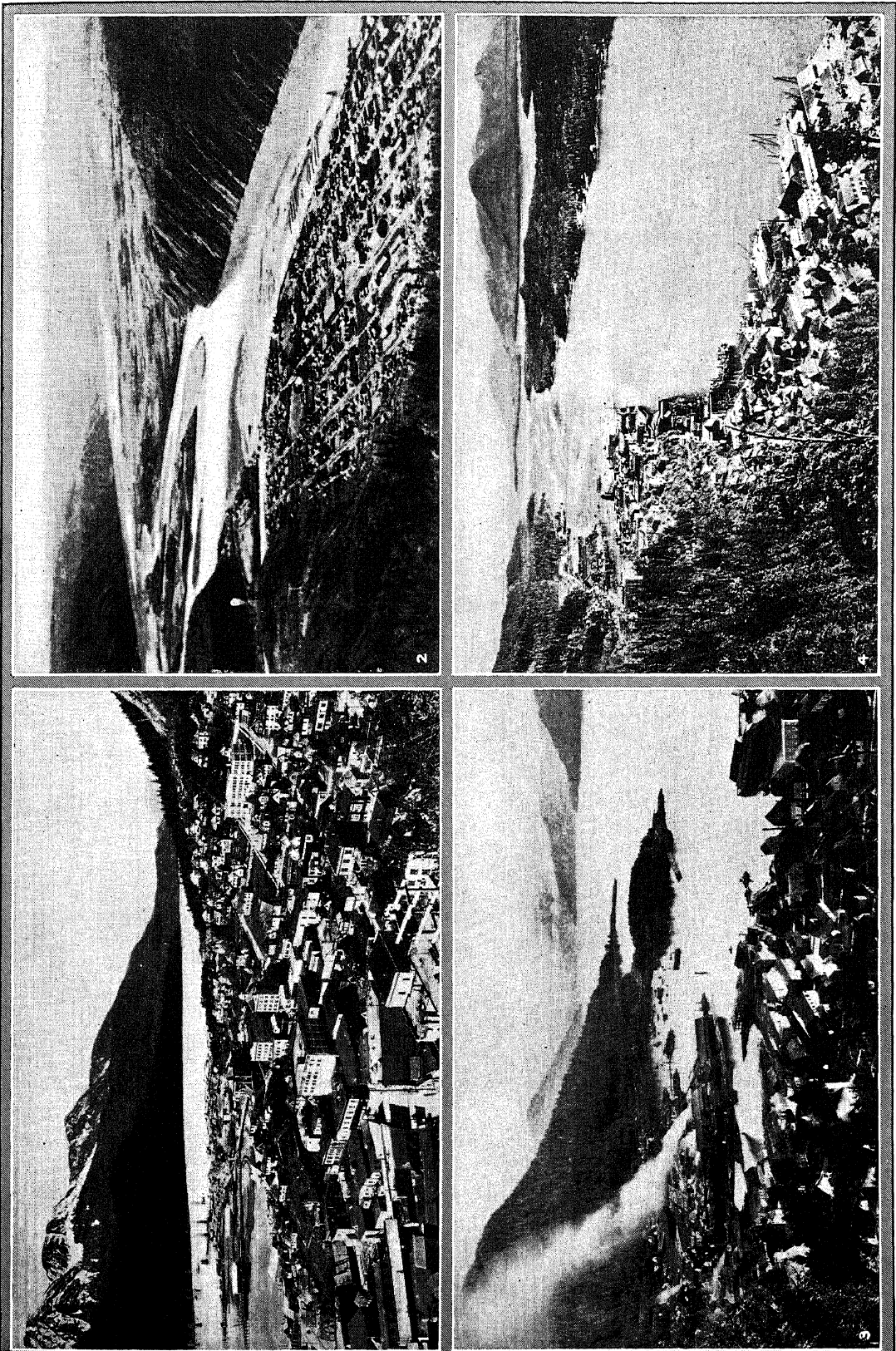
**Minerals.** Rich in minerals, Alaska has large reserves of gold, copper, coal, silver, platinum, tungsten, lead, marble and gypsum. A small amount of petroleum is now produced, but little is known about the reserves. The mineral resources are widely distributed throughout the central and Pacific regions.

Gold first attracted large numbers of people to the country and has held many there, since they have a permanent interest in Alaska in contrast with employees of the fish-canneries. Alluvial gold mining developed rapidly for a time along the Yukon and other interior streams. But as the bonanzas became exhausted and the yield per cubic yard of gravel grew small, production declined. Large power-driven equipment is necessary to work deposits profitably. Such equipment requires transportation facilities, far more of which must be provided before the mineral reserves can be exploited. Hard rock or lode mining can be conducted only where steamers, railroads or good highways are available and freight rates relatively low. Hence 97% of the gold taken from lodes has come from mines situated near the coast. More remote deposits must await cheaper means of transportation than exist at present.

The annual output of copper exceeds in value that of all the other minerals. It is produced in districts served by railroads or steamers, as in the Copper River Valley and near the coast. Copper deposits, however, are widely distributed. This is also the case with coal deposits, the reserves of which are estimated to be about 10,000,000,000 tons, at least half of which can be made easily available. Most of the reserves are of sub-bituminous coal and lignite, but the fuel value of the Matanuska and Bering River coal is as high as that of any other coal along the Pacific. The Matanuska field, where most of the present small annual production is obtained, is now served by a railroad.

The earliest recorded discoveries of paying quantities of gold were made in very widely scattered lo-

# ALASKA



## CITIES OF ALASKA AND THE YUKON TERRITORY

1. Juneau, territorial capital of Alaska. 2. Aerial view of Dawson, capital of the Yukon Territory, Canada, once a thriving boom town of the 'nineties.  
3. Wrangell, Alaska. 4. Ketchikan, a prosperous Alaskan city.







# ALASKA

Area, 586,400 sq.m.  
Pop. .... 59,278

## PRINCIPAL CITIES

(Including Figures from Latest Population Estimates)

### Pop.—Thousands

- 2 Anchorage L 13
- 1 Cordova L 5
- 2 Fairbanks H 14
- 4 Juneau N 22
- 4 Ketchikan P 25
- 1 Nome G 6
- 1 Petersburg O 23
- 1 Sitka O 22

### Pop.—Hundreds

- 3 Afognak O 12
- 2 Akiak K 7
- 1 Alitak P 10
- 3 Angoon O 22
- 1 Anvik J 8
- 3 Barrow A 11
- 1 Belkofsky R 5
- 3 Bethel L 7
- 1 Candle F 8
- 1 Chatanika G 14
- 1 Chichagof O 21
- 1 Chitina K 16
- 1 Circle G 16
- 2 Craig Q 23
- 6 Douglas N 22
- 1 Eagle H 17
- 1 Elm G 8
- 4 Eyak L 15
- 1 Flat J 9
- 3 Ft. Yukon F 15
- 1 Golovin G 7
- 3 Haines M 21
- 1 Haycock G 8
- 3 Holy Cross J 8
- 5 Hoonah N 21
- 3 Hyaburg Q 24
- 3 Hyder P 25
- 1 Igloo G 6
- 4 Kake O 23
- 1 Kanatak P 9
- 2 Karluk P 10
- 1 Kasan P 24
- 3 Kenai L 12
- 2 Kennecott K 17
- 1 Kiana E 8
- 1 Klukwan M 21
- 4 Kodiak O 12
- 3 Kotzebue E 7
- 1 Koyukuk G 10
- 3 Latouche M 14
- 1 McCarty K 17
- 5 Metlakatla Q 25
- 2 Naknek N 9
- 3 Nenana H 13
- 2 Noatak D 7
- 2 Noorvik E 8
- 2 Nulato H 9
- 2 Ouzinkie O 12
- 1 Pilot Sta. O 8
- 2 Quinhagak M 7
- 1 Rampart G 13
- 1 Ruby H 10
- 1 Russian Mission K 8
- 1 St. Michael I 7
- 1 Saxman Q 25
- 2 Selawik E 9
- 4 Seldovia N 13
- 8 Seward M 13
- 1 Shageluk J 8
- 2 Shishmaref E 6
- 1 Shungnak E 10
- 5 Skagway M 21
- 1 Stevens F 13
- 1 Takotna I 10
- 2 Tanana G 12
- 1 Tanana Crossing I 16
- 1 Tatitlek L 15
- 2 Tenakee N 22
- 1 Thane N 22
- 1 Tigara O 6
- 1 Togiak N 7
- 3 Unalakleet H 8
- 2 Unalaska R 2
- 2 Unga R 7
- 4 Valdez L 15
- 2 Wainwright A 9
- 2 Wales F 5
- 1 Wasilla K 13
- 2 White Mountain G 7
- 1 Wiseman D 13
- 9 Wrangell O 24
- 3 Yakutat M 19





calities, and were quartz lodes, not placers. The Apollo mine on Unga Island, off the western shores of the Alaska Peninsula, was among the first, if not the earliest to be developed. Juneau mine, 1880, was followed by Forty Mile, 1886, on the Yukon. Failing to win locations in the Klondike after the discoveries in 1897 which startled the world thousands of gold seekers rushed to the country, reaching Nome where the big discovery was made in 1898. Others, going to the Klondike by way of St. Michaels, discovered Rampart in 1898 and the Hot Springs in 1899; the overflow from the camps found Fairbanks in 1902. Practically all of these and subsequent discoveries were made in broad belts of slaty and mica schist rocks outcropping on both the southern and northern foothills of the great Alaska Range and the Endicott Mountains, the limiting walls of the Yukon Valley apparently being the most productive. The southern slopes of these mountain ranges have yielded the gold in Copper River Valley, and the placers of the Koyukuk, Chandlar and Squirrel Creek, which have held second place to those on the slopes facing north.

**Fisheries and Fur.** Fisheries are Alaska's most important industry, and were the first to be developed extensively. Fishing was carried on by the Russians long before the purchase of Alaska by the United States, and many American fishermen visited its shores regularly while it was still a Russian colony. The first salmon canneries were built in 1878. Now the elaborate plants include over 100 canneries and five hatcheries. Halibut, herring and cod are the other fish important in the canning industry. Salmon streams are found along more than 2,500 mi. of coast, and salmon spawn in the Yukon 2,000 mi. inland. Alaska produces yearly more than three-fifths of the very large salmon catch of Pacific America. The halibut fisheries have been over-exploited, and there is grave danger of their exhaustion. Since many of the halibut banks lie in international waters, they can be properly conserved only by international treaties. Herring are very abundant along the entire Bering Sea and Pacific shore lines of the territory.

The search for fur brought the Russians to Alaska, and the fur trade remained the chief interest of the country for more than a century. Ruthless hunting almost exterminated the sea otter and the seal of the Pribilof Islands. At one time not less than 3,000,000 seals visited these islands annually, but the number had been reduced to only about 125,000 when the government took over the sealing industry in 1911. By 1925 the herd approximated 700,000, and is expected to regain its former size. Alaska has many fur-bearing animals and annually produces fur worth nearly \$3,000,000. About three-fifths of this amount is obtained from the seal, and more than a third from the fox, muskrat and mink.

**Reindeer.** The first small herd of 10 reindeer was introduced in 1891. Through natural increase and by subsequent importations the number has grown to about 350,000, and at least 100,000 have been killed for food and clothing. The practicability of the in-

dustry has been fully demonstrated. Between 150,000 and 200,000 sq. mi. of natural grazing lands are available and are capable of maintaining three to four million head. There is now a regular shipment of reindeer meat to Seattle for distribution. The Alaska Agricultural College made very satisfactory progress in 1929 with experimental cross-breeding of reindeer and caribou.

**Flora and Fauna.** Alaska is a land of flowers, ferns, mosses, lichens and mushrooms, which spring up everywhere as soon as the snow disappears. It is probable that more than 2,000 species of flowering plants and shrubs are native to the territory. There are hundreds of species of ferns and grasses. Many of these are common to circumpolar regions, and there are a few which are common flowers of the United States. Red and yellow columbines, blue lupines, aconite and larkspur give color to the forest borders.

The principal wild game of Alaska are: among the ruminants, the moose, mountain sheep, goat, deer and caribou; and among the carnivores, the brown or Kodiak bear. There are 13 varieties of bears recognized by scientists, but they belong to only four general types; the brown, the grizzlies, the black and the polar bears. The most numerous are the brown bears, huge in size and with a reputation for ferocity equal to that of the grizzlies. The abundance of bird life, beside the innumerable water fowl, is a revelation to the stranger. Besides the permanent residents such as the ravens, crows, hawks, owls, eagles, ptarmigan and grouse, the migratory birds arrive in thousands at about the end of April, and return in August and September on their southbound journey.

**Communications.** The mining developments in certain parts of Alaska have entailed some railroad construction, viz., the Copper River and Northwestern Mineral Line which runs from the Kennicott mines in Wrangle Mountains along the Copper River Valley to the ice-free port of Cordova. To assist entrance to the Yukon gold districts there is a railway from Skagway over White Pass, 2,888 ft. in elevation, and down to the navigable Yukon River at Whitehorse. A government railway has been constructed from Seward via the Susitna Valley to Fairbanks, with a branch line to Chickaloon along the Matanuska Valley coal field.

Unfortunately the Yukon can be entered only from the Bering Sea, and is closed by ice for all but three months of the year. Moreover, the delta channels are shallow. In the season there is through navigation for river steamers to Whitehorse in Yukon; that is, for a distance of more than 2,000 miles. Its tributary, the Tanana, which flows through the most promising valley for cereal agriculture in Alaska, is navigable almost to Fairbanks. There is a government road from Fairbanks to Valdez, on Prince William Sound. Morasses are likely to hinder cross-country movement in summer.

**Population and Towns.** Alaska's population has risen and fallen with the fluctuation in gold produc-

tion. Hopes of a quick fortune brought a rush of prospectors, who left when these hopes were not realized. In 1920 the population was only 55,036, and more than three-fifths was in the southern and southeastern districts. In 1930 it had risen to 59,278. Nearly half the total population consists of Indians and Eskimos. The principal incorporated towns with their populations in 1930 were Juneau, 4,043; Anchorage, 2,277; Ketchikan, 3,796; Sitka, 1,056; Fairbanks, 2,101; Nome, pop. 1,213, in the Seward peninsula, 2,372 mi. from Seattle, was once the center of a rich gold mining district; now, however, it has few inhabitants. Skagway is the chief port.

The natives of the country may be divided into four stocks: the Eskimos, who live on the coasts of Bering Sea and the Arctic Ocean, and in the northern valleys for a short distance above the coast; the Aleuts, who inhabit the southern coasts west of Copper River, and the Aleutian Islands; the Achabaskans, who live along the rivers, reaching the ocean only at the head of Cook Inlet; and the Thlingets, Hidahs and Tsimshians, on the coasts and islands east and southeast of Copper River. The origin and early history of the aboriginal Alaskans cannot definitely be stated, and they have no well-defined traditions.

**Education and Government.** The public schools of Alaska are maintained for white children and for children of mixed blood. The following towns have schools which offer four years of high school work: Juneau, Fairbanks, Anchorage, Douglas, Ketchikan, Valdez and Nome. About 600 pupils are enrolled in the high schools and 3,750 in elementary schools. There are schools for natives, supported by the federal government and by missions. The Agricultural College and School of Mines at Fairbanks is the only institution of higher education.

The township of Noorvik, the work of the United States Bureau of Education, is a model town of 300 inhabitants. It is an inland educational center for numerous Eskimo villages, and overcomes the difficulties of working in scattered settlements with but a few children in each. At Noorvik the children can be taught together, and at the same time be removed from the demoralizing influences of the coast.

After the purchase of the territory in 1867, a special commissioner was appointed to take possession of the region; other than the commissioner, however, Alaska remained without civil government until 1884. Until that date the country had been only a customs district with a collector and a few deputies. For laws, the territory had the regulations made by the Secretary of the Treasury; and for protection the presence of a war vessel. Civil government was established in 1884, when, by act of Congress, Alaska was created a civic and judicial district, and a governor was appointed. In 1912 the status of Alaska was altered to that of an organized territory, with a capital at Juneau, the government headquarters having been, previous to this time, at Sitka. A legislature consisting of a Senate and House of Representatives was created at Juneau. The Senate consists of eight, the

House of Representatives of 16 members. The executive power is held by the governor, who is appointed by the President, by and with the advice of the Senate of the United States, for a term of four years.

**History.** Alaska was first visited by the Russians in 1741, and Russian traders and trappers soon thereafter entered the country to obtain fur. In 1784 they established the first settlement, on Kodiak Island, and in 1804 founded Sitka, which became the seat of government the following year. During the 83 years that Russia occupied Alaska she obtained \$45,000,000 worth of furs, but made little effort to develop the country. The 500 colonists were provided even with food from Siberia. Russian rule ended in 1867 when the United States purchased Alaska for \$7,200,000.

Following the **BERING SEA CONTROVERSY**, in 1896 a dispute arose between Alaska and Canada concerning ownership of territory adjoining British Columbia, and was settled by arbitration in 1903 (*see ALASKA BOUNDARY TRIBUNAL*). President Roosevelt, wishing to conserve Alaska's natural resources, established restrictions on exploitation. As this program worked out the country did not progress industrially; legislation was passed in 1914, however, which improved conditions. The completion of the Alaskan railroad in 1923 was of great importance in the development of the territory.

**ALASKA BOUNDARY TRIBUNAL.** When Alaska was acquired by the United States in 1867, the interior boundary was equivocally defined, and had never been surveyed. The question was postponed until the discovery of the Klondike gold fields, 1896, in the disputed region made an immediate adjustment necessary. When the Anglo-American joint high commission met at Quebec in 1898 to settle matters relating to commercial reciprocity and fisheries, the Canadian delegates introduced the Alaskan boundary question, attempting to narrow the Alaskan coast strip so as to give Canadians access to several good harbors. The United States made a temporary concession, fixing a provisional line which gave Canada possession of several points hitherto always regarded as within American jurisdiction. On Jan. 24, 1903, the United States and Great Britain agreed by treaty to establish the Alaskan Boundary Tribunal of three British members and three Americans. Elihu Root, Henry Cabot Lodge and George Turner were the American members. Two of the British were Canadians, committed to extreme Canadian claims; the third was Lord Alverstone, Chief Justice of England. Meeting in London from Sept. 3-Oct. 20, 1903, the tribunal decided against the Canadian contentions (Lord Alverstone voting with the American delegates), fixed the boundary definitely, shutting off Canada from the seacoast north of 54° 40', and ordered surveys.

**ALASKITE**, an **IGNEOUS ROCK** of coarse to fine texture, light-colored, consisting almost exclusively of **QUARTZ** and **ORTHOCLASE**. With increasing amounts of **BIOTITE**, **HORNBLende** or **AUGITE**, alaskite passes into **GRANITE**.

**ALASTOR** or "The Spirit of Solitude," a poem in blank verse by P. B. SHELLEY; published 1816. This work, which takes its name from the personage in Greek mythology who represents the fury-like avenging spirit, tells of the poet's quest through the world for beauty, his search for some answer to the questions which torment his mind, and of his discovery at last that the world is nothing but a crowded solitude, a haunting, vengeful Alastor.

**ALB** (from Latin *albus*, white), an ecclesiastical vestment of white linen, reaching to the ankles, with narrow sleeves and a girdle or cingulum, adapted from the Roman tunic. It became the official garb at the introduction of Christianity as the State religion and remained unaltered in form and cut all through the Middle Ages. The alb, which is often ornamented with lace, is now specifically a Mass vestment. In the Greek Church its place is taken by the silk *sticharion*, usually colored. A silk alb was also a coronation garment of the German emperors, and one of this type has been preserved with the coronation insignia in the Hofburg, at Vienna.

**ALBACETE**, a city of southeastern Spain, capital of Albacete province. It has remains of fortifications in the upper city, a bull ring, numerous cutlers' workshops, and holds an important annual fair. Est pop. 1929, 32,000.

**ALBA LONGA**, the most ancient city of Latium in Italy, said to have been the founder of Rome. It took the name *Longa* from the fact that it stretched from the Alban Mount in the direction of the Alban Lake, the modern Lago di Alba. Alba Longa was believed to have been founded 300 years before Rome by Ascanius, son of Aeneas. When destroyed by Tullus Hostilius, it was never rebuilt. The later Roman emperors, Pompey and Domitian among them, built magnificent villas at Alba Longa, making the region, with its vineyards and carefully cultivated soil, one of the beauty spots of the empire.

**ALBAN, ST.**, the first martyr in Britain. According to tradition Alban, a pagan, sheltered a fugitive priest through whom he was converted and baptized. When the house was searched Alban assumed the priest's costume, was arrested and, refusing to forswear the faith, was scourged. Led to execution, he stopped the flow of a stream, which was crossed dry-shod, and the executioner was also converted. But a substitute struck the blow and immediately went blind. It is stated that the cleric was stoned to death at Redbourn, four miles from St. Albans.

**ALBANIA**, an independent kingdom with an estimated area of about 10,600 sq. mi., is situated in the southwestern part of the Balkan Peninsula and is bounded on the west by the Adriatic Sea, on the north and east by Yugoslavia and on the south by Greece.

**Surface Features.** High mountain chains traverse the country, with long narrow valleys running from northwest to southeast lying between them. The highest range are the Albanian Alps in the northern part of the country, reaching to a height of nearly

9,000 ft. Small lakes dot the Albanian valleys, and LAKE SCUTARI, on whose shores is situated the town of Scutari, is one of the largest in the Balkans and one of the most beautiful in all Europe. Of LAKE OCHRIDA on the Macedonian frontier only the southwestern corner is in Albania, the major part of that lake being in Yugoslav jurisdiction. The principal rivers, none of which is navigable, are the DRIN, the Shkumbi, the Devol and the Voissa. The Drin is formed by the junction of two headstreams, the Black Drin and the White Drin, both of which have their sources in Macedonia and meet in Albania near Prizren. The Shkumbi also rises in the eastern part of the country, near the Macedonian border, and follows a tortuous course amid wooded mountains across central Albania. Like the Shkumbi, the Devol flows directly westward and empties into the Adriatic just north of Valona. The Voissa rises in the mountains near the Greek frontier and after traversing the southwestern corner of Albania falls into the Adriatic near Valona. The climate of Albania is like that of most Balkan countries. Certain sections in the south along the Adriatic and the Aegean enjoy Mediterranean weather and grow olives, lemons and oranges. In the mountains the winters are harsh but in the valleys mild weather predominates throughout the winter.

**Population.** The River Shkumbi which divides the country into northern and southern Albania is also the dividing line between Ghegs and Tosks, the two groups of people which form the Albanian nation. The Ghegs of the north are taller and sturdier, but less influenced by civilization. The Tosks, having fallen under Greek influence, are more advanced in education. Both groups speak the same language, with a slight difference in dialect. The population of Albania in 1930 was 1,003,068. The country is divided into ten prefectures, named after the chief towns, which are the capital Tirana, Koriza, Dibra, Berat, Durazzo, Elbasan, Argyrokastro, Scutari and Valona. (See also separate articles on these towns.)

**Religion and Education.** About 70% of the Albanian people belong to the Moslem faith, but they are independent of the caliphate and monogamy is the rule among them. Of the remainder, two-thirds are Greek Orthodox and one-third Roman Catholic. There are metropolitans in Durazzo, Berat, Argyrokastro and Koriza, while the Roman Catholics have divided the country into five bishoprics, with an archbishop and an apostolic delegate in Scutari. Like their Moslem brothers who voted their religious independence from the caliphate, the Greek Orthodox Albanians recently established the Autocephalus Greek Orthodox Church of Albania, recognized by the patriarch of Constantinople.

In Turkish days there was little opportunity for education in Albania. But the present government has made considerable progress in this neglected field and in 1928 there were 586 primary, 12 continuation and 4 secondary schools and a teachers' college at



Elbasan, besides 2 French lycees and 4 American training schools for girls and boys. In Scutari there is a Jesuit college.

**Finance.** Albania is a poor country and the revenue, which in 1929-30 was 31,827,200 gold francs, is hardly sufficient to defray the cost of administration. The monetary unit is the *lek*, now equivalent to 4 cents, but normally to 20. In 1925 Italian financiers established in Rome the National Bank of Albania, which handles the financial activities of the country and has branches in Tirana, Durazzo, Koriza, Valona and Scutari.

**Production.** There are vast forests of oak, walnut, chestnut, elm and pine trees in the country, but they have not as yet, 1932, been utilized. The mineral wealth is likewise considered to be quite large, and copper, salt and petroleum mining are receiving some attention. Tobacco, lumber, wool, hides, furs, corn and olives and olive oil are the principal products of the country. Agriculture is the principal occupation of the inhabitants, and each family raises enough for its own use.

**Transportation and Trade.** From the ox-cart to the airplane without the intermediate stage of the railroad is the story of Albanian transportation. There are no railroads in the country, but regular air passenger service is maintained between Tirana and Scutari, Tirana and Koriza, Tirana and Argyrokastro and Tirana and Peshkopi. A railway is however now under construction (1931) between Tirana and Durazzo, a distance of 22 mi. It is planned to connect Durazzo with Monastir by rail and thereby with Salonika and the rest of the European systems. Of the ports Durazzo and Valona are the busiest. Santi Quaranta and San Giovanni di Medua also offer anchorage to small vessels. The total length of the roads is about 1,000 mi., of which only a little more than half is open to motor traffic.

**History and Government.** The Albanians are among the oldest inhabitants of the Balkan Peninsula, and in its early history parts of the region were held at various periods by the Roman Empire, the Goths, Serbia, Bulgaria, Byzantium, the *despotate* of Epirus, and by Sicily.

The advance of the Turks in the 15th century found the country governed by various native chieftains. To stem the tide of the Turkish hordes the chieftains united their tribes under the leadership of Skanderbeg (George Kastrioti). Although the Turks took Yannina in 1431 they could not subjugate the entire country until 1571. For the next three and a half centuries Albania remained under Turkish rule. At certain times, however, parts of it enjoyed virtual independence. In the middle of the 18th century Mahmed Mushati, Pasha of Scutari, threw off Turkish suzerainty, and toward the close of the same century Ali Tepeleni proclaimed himself independent at Yannina. After Ali's death Turkish authority was re-established over the Albanian provinces.

In 1912, following a general uprising, the Porte granted autonomy to Albania. At Valona, in No-

vember, independence was proclaimed. During the World War the country was occupied by Allied and Austro-German forces. On Jan. 22, 1925, the National Assembly proclaimed Albania a republic and on Feb. 1, Ahmed Beg Zogu was elected the first president. Less than four years later, on Sept. 1, 1928, the Albanian Constituent Assembly amended the constitution and voted the republic a monarchy, electing Ahmed Beg Zogu as the first king of Albania under the title Zog I. In the administration of the country King Zog is assisted by a council of ministers appointed by himself. The Albanian constitution of Nov. 22, 1928, provided for a chamber of deputies, one deputy for every 15,000 inhabitants.

**ALBANIAN**, a SATEM LANGUAGE of the INDO-EUROPEAN linguistic family, of which it now constitutes an independent branch, spoken in the kingdom of Albania with scattered colonies in Greece, Sicily and southern Italy. It is almost certainly the modern representative of the ancient ILLYRIAN stock, thus being cognate with the extinct Phrygian, Macedonian, Thracian and Messapian and possibly with the extinct Pre-Sabellian and Novilaran (*see* separate articles on these subjects). It falls into two main dialects delimited by the Shkumbi River: Gegish in the north and Toskish in the south, the latter being the more conservative. It has only two case-forms, nominative-accusative and genitive-dative, and the article is post-fixed, as in RUMANIAN, e.g., *mal* "mountain," *mali* "the mountain." The whole inflectional system is much decayed, and the vocabulary is extremely composite, some 77% being borrowed from Greek, Turkish, Italian and Slavic. *See* separate articles.

Albanian literature seems to begin with a baptismal formula of 1462, followed by a translation of the Bible in 1555. A large number of religious works have been published in Gegish; Toskish literature, largely secular, began in the 19th century; and many folk-songs and folk-tales have been collected.

L. H. G.

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**ALBANIAN LEAGUE.** In 1878 the European statesmen were made acutely aware of the existence of a national spirit among a people which hitherto had occupied but a small place in continental diplomatic maneuverings, namely, the Albanians or Skipitari. In that year the CONGRESS OF BERLIN, while readjusting the territorial contours of the Balkan Peninsula, without ado had assigned to Montenegro and Greece some lands inhabited by Albanian subjects of the sultan. In protest against this measure an Albanian League was formed in 1878 at Prizren and a vehement dissent against the alienation of Albanian soil was lodged with the powers. The League met with some success in its endeavor to secure restitution of the land, particularly since Sultan Abdul Hamid II, seeing a chance to regain a portion of the territory of which he had

been deprived, gave it considerable support. But when his purpose had been served, the Sultan had no desire to witness the further growth within his domains of a nationalistic society. In 1879, accordingly, the League was suppressed.

**ALBANY**, a city in Alameda Co., western California, on San Francisco Bay. It is a branch of the Berkeley post-office, and is served by the Santa Fe and Southern Pacific railroads through the Berkeley railroad station. Pop. 1920, 2,462; 1930, 8,569.

**ALBANY**, a city in southwestern Georgia, the county seat of Dougherty Co., on the Flint River, 150 mi. south of Atlanta. It is a commercial and railroad center, served by five railroads. There is also a municipal airport. The surrounding country, once a strictly cotton growing region, has developed various other crops since the boll weevil pestilence, especially the famous paper-shell pecans and peanuts. Cotton, however, is still profitable. The retail business in 1929 amounted to \$8,796,618. Albany was founded in 1836 by Nelson Tift, of Conn., who was prospecting for timber. Radium Springs, near the city, are of great interest and value. Pop. 1920, 11,555; 1930, 14,507.

**ALBANY**, the state capital of New York and county seat and port city of Albany Co., is situated about midway between the northern and southern limits of the state on the Hudson River, 143 mi. north of New York City. Bus and truck lines, airplanes, steamships, the barges of the state canal system and five railroads serve the city. Since the spring of 1931 Albany has been a port for ocean-going vessels, as the result of the deepening of the Hudson River channel. It has many fine architectural examples of the early Dutch colonization, begun in 1614. The Schuyler Mansion is now the state museum. The capitol is built of Maine granite. The New York State Education building is a handsome structure in classical style, and the state office building, opened in 1930, is 32 stories high and occupies a city block. Albany is the seat of the state normal college and library and Albany Law School, College of Pharmacy and Medical College. The city has a 60-bell municipally-owned carillon. Albany is a commercial and manufacturing center; the chief products are chemicals, stoves, textiles, paper, iron and brass goods, machinery and electric heaters. In 1929 the factory output was worth about \$52,000,000; the wholesale trade proper amounted to \$58,052,044; and the retail, to \$101,808,711. The city was chartered in 1686 by Governor Dongan, royal colonial governor. Pop. 1920, 113,344; 1930, 127,412.

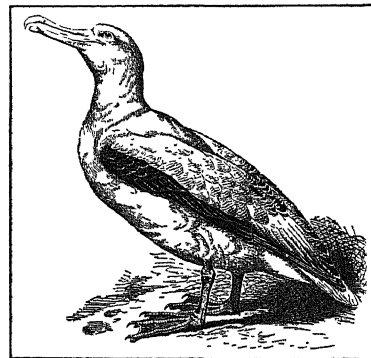
**ALBANY**, a city in western Oregon, the county seat of Linn Co., situated on the Willamette River, 78 mi. southwest of Portland. It is served by river craft, bus and truck lines and the Oregon Electric and the Southern Pacific railroads. There is a municipal airport. Albany is a railroad center and shipping market for cereals, fruits, nuts and vegetables. The chief manufactures are meat and dairy products, leather and furniture. Albany College is located here. Near by are soda and hot mineral springs.

On the east is Santiam National Forest, and on the west Siuslaw National Forest. Pop. 1920, 4,840; 1930, 5,325.

**ALBANY CONGRESS**, 1754, a conference called at the recommendation of the Lords of Trade to confirm the friendship of the Iroquois and the English colonists and to consider plans for a permanent intercolonial union, primarily because of the impending FRENCH AND INDIAN WAR. It was a landmark in the development of intercolonial union. The Congress, meeting at Albany on June 19, was attended by 150 Indians and by commissioners from seven colonies. After cementing the alliance with the Indians, the Congress adopted a plan of union submitted by BENJAMIN FRANKLIN. The plan proposed a president-general, to be appointed by the Crown; a grand council, its members to be elected by the various colonial legislatures; the president-general and council to have the full management of Indian affairs, the power to raise armies and navies, to levy duties and taxes for intercolonial purposes, and to make new settlements; all enactments to be valid unless vetoed by the Crown within three years. The plan was rejected by the constituent colonies and ignored by the Crown; but it was the first comprehensive plan of union formally proposed.

**ALBANY REGENCY**, the coterie of Democratic leaders in New York State, 1820-48, including Martin Van Buren, William L. Marcy, John A. Dix and Silas Wright, which controlled the patronage and dictated the general policy of the party. The regency represented control by the "best minds" of the party, and was comparatively free from corruption. It lost power and prestige when the Democratic Party in New York State split into irreconcilable factions. See BARN BURNERS; HUNKERS.

**ALBATROSS**, a family (*Diomedidae*) of large, ocean-going birds, akin to the petrels and fulmars, and like them well-described by the older name Tubinares or Tube-nosed, the nostrils opening through



WANDERING ALBATROSS

a tube on the upper mandible. The albatrosses, numbering about 18 species, are birds of the Southern and Pacific oceans, nesting on remote oceanic islands. The wandering albatross (*Diomedea exulans*) is the largest of the family, and one of the largest of birds,

with a wing-spread of nearly 12 ft., equaling the California condor, largest of land birds. It often follows ships for days, soaring over the waves with admirable ease and grace, no movement of the wings being perceptible. The albatross disappears in the hollow of the waves, rises again, swings forward, turns this way and that, with only a change of the angle of the wing. The single egg of the wandering albatross is about 5 in. long, yellowish-white and usually speckled. Five species of albatross are included in the list of North American birds. They are the black-footed albatross (*D. nigripes*), a uniform dusky brown; the short-tailed albatross (*D. albatrus*) white with black on the wings, which breeds on islands off Alaska, laying one large white egg; the Laysan albatross (*D. immutabilis*), with white head and body and black wings and tail, which breeds on Laysan Island near Hawaii, and sometimes approaches the coast of California; the yellow-nosed albatross (*Thalassogeron culminatus*), uniform brownish gray above with white upper tail coverts and under parts, which belongs to the Indian and Pacific oceans, and also sometimes reaches California; the sooty albatross (*Phoebastria fuliginosa*), sooty gray and brown, distinguished by a grooved bill and wedged tail, which sometimes reaches the coast of Oregon. Other members of the family are the royal albatross (*D. regia*) of New Zealand; the white-winged albatross (*D. chionoptera*) of the Indian Ocean; and the spectacled albatross (*D. melanophrys*) with gray marks about the eyes. All indulge in ceremonial nuptial dances. C. J.

**ALBEDO**, or whiteness, as used in astronomy is defined as the ratio of the total amount of light reflected from a body in all directions to that falling upon it. It is employed to describe the reflecting power of the moon and the planets. Thus, the albedo of the moon is 0.073, indicating that the moon reflects only 7% of the sunlight falling upon it.

**ALBEMARLE SOUND**, a large inlet in the northeastern part of North Carolina. It has an east and west direction, extending from the mouths of the Chowan and Roanoke rivers nearly to the Atlantic Ocean, from which it is separated by a long narrow island. It is about 50 mi. long, with a maximum width of 15 mi., and a depth which varies from 2 to 20 ft. It is connected with Norfolk harbor on the north and Pamlico Sound on the south by a system of natural and artificial waterways. It forms an important link in the inland waterway system extending from Massachusetts to North Carolina.

**ALBERDI, JUAN BAUTISTA** (1810-84), Argentine statesman, sociologist and writer, born Aug. 29, 1810. He studied in the College of Moral Sciences of Buenos Aires and joined the Association of May, an organization against Rosas. In 1838 he went to Montevideo and Chile and devoted himself to journalism and law. He lived in exile much of his life. In 1852 his *Bases para la organización política de la Argentina* appeared. Alberdi was a member of the constituent assembly and largely responsible for the Federal Constitution of Argentina of 1853. His complete works,

which appeared just before his death, are an excellent history of Argentina from 1830 to 1880. He is considered one of Argentina's greatest thinkers. His deep insight into the problems of Latin America is revealed in his *Peregrinacion de Luz del Dia o Viaje y Aventuras de la Verdad en el Nuevo Mundo*, a pilgrimage of truth or the light of day throughout America. He died June 18, 1884, in Paris.

**ALBERT I** (1875- ), King of Belgium, the son of Philip, Count of Flanders, and the nephew of Leopold II, was born in the city of Brussels, on Apr. 8, 1875. In his studies in naval and aerial construction he evinced talent in mechanics, and was a student of military training in the French Military school. Because of the death of the son of Leopold II in 1869 and the death of Prince Baldwin in 1891, Albert became heir to the Belgian throne in the latter year. In 1900 he was married to Elizabeth of Bavaria. In 1898 he visited America, and in 1908 he spent some time in England studying naval engineering. In 1909 he went to the Belgian Congo, and made a trip down the Congo River to its mouth. On his return to Belgium he became king on Dec. 1, 1909. His address at his coronation included the sentence, "Our prosperity depends upon the prosperity of the masses." Besides organizing the standing army, he sponsored reform measures, and patronized artists and writers. In 1914 he personally called the neutrality of Belgium to the attention of Wilhelm II. During the World War, in which he led the army, Albert showed particular courage, subjecting himself to all dangers, while Elizabeth served as a nurse in a government hospital and the Crown Prince was a common soldier. In 1918 before the armistice Albert formed a new government of the three most powerful political parties, and after the armistice urged that all parties unite in the work of reconstruction. He also asked that the neutrality of Belgium provided in the treaty of 1839, be abolished. For establishing temporary abodes for the destitute, he contributed large sums to the fund from his own purse, named King Albert's Fund. In the post-war period he sponsored the development of the merchant marine, the enlargement and improvement of education facilities and the relief of the people during times of trouble. In 1926 the stabilization of finances program of Jaspar resulted in the creation of the Belga, a new unit of currency worth five Belgian francs.

**ALBERT**, Prince Consort of England (1819-61), husband of Queen Victoria of England, was born at Coburg, Germany, the second son of the Duke of Saxe-Coburg-Gotha. Educated with care, Albert was selected by King Leopold of the Belgians, uncle of Victoria, and by Baron Stockmar, her confidential adviser, as a candidate for her hand. When the pair, who were first cousins, met in England the attraction proved mutual. Their marriage took place in London on Feb. 10, 1840. Prince Albert did not receive the title of Prince Consort until 1857. Though his position was not an easy one, it is conceded that he mastered it with tact, and finally won the confidence

and affection of the English people. He was interested in the development of industry, and it was on his initiative that the Great Exhibition of 1851 took place in London. He died at Windsor Castle, Dec. 14, 1861.

**ALBERT, JOSEPH** (1825-1886), German inventor of the Albortype, a picture printed in ink from a photographic plate of gelatine and albumen, sensitized with potassium bichromate. Albert was born at Munich, March 5, 1825, and died there May 5, 1886. The Albortype process exerted great influence on the development of photography.

**ALBERTA**, a province of Canada, a huge sloping plateau forming the largest and most westerly of the prairie provinces. There are three sections of the province, known as southern, central and northern Alberta. Southern Alberta is a district of treeless prairie rising on its western side into the foothills of the Rockies. The Saskatchewan River drains a great part of this area. The central district is covered by well-watered and timbered lands, the greater parts of which are drained by the Saskatchewan. In northern Alberta there are prairie and forest areas drained by the Peace and Athabasca rivers, flowing into the Mackenzie. At least two-thirds of Alberta is still in a natural wild state.

**Area and Population.** The province has an area of 255,285 sq. mi.; it is about 750 mi. long, 180 mi. wide at its southern base and 400 mi. wide at its northern base. The southern boundary is the international border between the United States and Canada; the northern boundary is the Northwest Territories; to the east is Saskatchewan and to the west the Rocky Mountains and the 120 meridian. The population in 1901 was 73,022; in 1921, 588,454; in 1931, 731,605. The English-speaking element is predominant, and is composed of settlers from eastern Canada, Great Britain and the United States. Small groups from northern European countries are found in the central section.

**Cities and Towns.** EDMONTON is the capital. CALGARY is the largest city of the province. Lethbridge, Medicine Hat, Red Deer and Wetaskiwin are also important.

**Climate.** The winters are very cold, but are varied periodically by spells of mild weather due to the famous Chinook wind from the west or southwest. The summers are warm and long, with cool nights. The annual rainfall is between 15 and 20 in.

**Forestry.** The principal timber is poplar, pine, birch, spruce and fir. In the original forests the spruce tree predominated, but as the result of many fires it has lost its supremacy. About one-third of the total area of Alberta is essentially forest land. In 1930 the amount of merchantable timber in the northern district was estimated at a total of about 30,000 million c. ft.; over 50 sawmills were located in this area. With the exception of birch and poplar, Alberta's forests are wholly coniferous.

**Dominion Parks.** The Rocky Mountains of Alberta make ideal recreation centers. Here are lo-

cated the large and popular national parks: BANFF and Jasper. Animals, game and fish may be found in these, and in the Waterton Lakes forest regions.

**Fur.** In the northern section of the province the fox, beaver, coyote, bear, muskrat, lynx, badger, mink, marten, otter, skunk, rabbit and wolf abound, providing abundant sport and occupation for the tourists and trappers. Fur has always produced a large revenue for the province and there is every indication that it will continue to do so.

**Fisheries.** Whitefish, pickerel, pike and trout are plentiful in the lakes, rivers and streams of Alberta, which comprise a water area of 2,360 sq. mi. There is little fishing for export, most of the catch being consumed locally.

**Agriculture.** Alberta is adapted in varying degrees to the growing of wheat, oats, barley, rye, peas, flax and alfalfa. The soil of the province consists of a finely divided basis of glacial drift, topped by accumulations of vegetable mould varying in depth from a few inches to several feet. Wheat is the main crop, with oats a close second.

The prairie plains region is essentially an agricultural district. Up to 1931, of 60,000,000 acres classed as land capable of agricultural development, only about one-fifth was under cultivation. As early as 1809 crops of vegetables and cereals were produced at the trading posts in what is now Alberta.

#### PRINCIPAL FIELD CROPS, ALBERTA

1930 and Five-Year Average 1925-1929

Crop	Area	Yield Per Acre	Total Yield	Total Value
	acres	bu.	bu.	\$
Wheat .. 1930	7,164,000	18.6	132,900,000	51,831,000
Av. . . 1925-29	6,403,819	20.2	129,353,600	125,464,000
Oats . . 1930	2,165,000	36.0	77,940,000	11,691,000
Av. . . 1925-29	2,064,294	33.7	69,518,800	27,755,400
Barley .. 1930	748,000	25.4	18,999,000	2,660,000
Av. . . 1925-29	500,342	24.3	12,156,400	5,868,600
Rye ... 1930	247,000	15.0	3,714,000	557,000
Av. . . 1925-29	141,603	14.7	2,086,800	1,590,000
		cwt.	cwt.	
Potatoes ... 1930	30,100	84.0	2,536,000	2,029,000
Av. . . 1925-29	26,316	81.0	2,130,400	2,683,800
Turnips ... 1930	3,100	101.2	314,000	236,000
Av. . . 1925-29	6,608	116.1	767,000	1,024,400
Hay and		tons	tons	
clover . 1930	351,800	1.47	517,000	4,653,000
Av. . . 1925-29	245,456	1.53	374,800	4,231,000
Grain hay .. 1930	1,750,000	1.75	3,063,000	19,910,000
Av. . . 1925-29	1,587,593	2.34	3,712,200	37,062,600
Alfalfa .. 1930	33,200	2.10	70,000	910,000
Av. . . 1925-29	38,280	2.46	94,000	1,240,400
Sugar beets.. 1930	14,500	9.00	131,000	858,000
Av. . . 1925-29	5,859	8.98	52,600	370,400

**Livestock.** Throughout the province the large horse and cattle ranches are gradually giving place to mixed farming, due to the large grain yields produced by the introduction of irrigation. Ranching is conducted in the foothills of the Rockies, on a few ranches in the prairie region and on the edges of the settled parts of the Peace River district. Better

types of beef cattle are being produced by the mixed farmer. Sheep are raised in many districts. The foundation of the Albertan ranching industry was laid during the decade 1870-80 by the importation of Montana cattle to the Macleod district.

**Industries.** The principal activities of many extensive manufacturing establishments include flour milling, sawmilling, manufacture of food products, tanning, meat packing, brewing, printing and publishing.

**Mineral Resources.** Coal, gas and oil have contributed to make Alberta a mining province. Although the output of Nova Scotia is larger, Alberta is the greatest coal bearing province in the dominion. There is also a greater variety of coals than in any of the other provinces, as all ranks from lignite to semianthracite are represented. The total estimated reserves of coal in Alberta have been placed at 1,072,627,400,000 metric tons, or about 87% of all the coal in Canada. An estimate made by the International Geological Congress states that existing mines in Alberta are capable of producing 15,000,000 tons annually, and at this rate they would not exhaust the total reserve in 1,800 centuries.

MINERAL PRODUCTION, ALBERTA, 1929

Item	Production	Value \$	Rank Among Provinces
Coal . . . tons	7,150,693	22,928,182	2
Natural gas M cu. ft.	19,112,931	4,684,247	2
Petroleum, crude . bbl.	988,675	3,458,177	1
Clay products . .		1,342,427	3
Cement . . . bbl.	808,796	1,770,786	4
Sand and gravel tons	1,721,930	447,993	5
Other products . . .		108,174	—
Total all products . .		34,739,986	4

The Hudson Bay post, established at Fort Edmonton in 1795, is known to have used coal for fuel at a very early date, and there is some evidence to support the theory that Indians occasionally used it even before the advent of the white man. Probably, however, the earliest known discovery in the present province of Alberta was the finding of coal in what is now the Drumheller area about the year 1798, by Peter Fidler. Actual commercial development in the province dates from 1872. Sir Alexander Galt began a development of Alberta's coal on a big scale in 1882. The coming of the Canadian Pacific Railway at about this time was also an aid to the industry, which from that period has shown a consistently steady expansion. In 1886 the production was 43,220 tons; in 1909 more than 2,000,000 tons, and after 1928 well over 7,000,000 tons annually.

The province has attracted much attention by its oil and gas possibilities. The first well was drilled for water in 1885 by the Canadian Pacific Railway Company in the Medicine Hat field. Gas was struck in this well, and in 1890 another well was drilled near the same spot, when gas at a good pressure was encountered. Since that time many wells have

been sunk, so that by 1912 this field was capable of producing 25,000,000 cu. ft. of gas a day, and in 1928 the daily capacity from 28 live wells was estimated at 63,000,000 cu. ft.; the total capacity of all the fields in the province in that year was estimated at 480,000,000 cu. ft. a day.

Oil has been discovered in a number of places in the province, but the quantity has been relatively small. A new field was found near the international border in 1929. The high cost of transportation of coal and gas to the eastern provinces makes it evident that Alberta needs local markets for her output.

The total production of minerals in 1928 was valued at \$32,367,781.

**Transportation.** The main lines of the Canadian National and the Canadian Pacific railways traverse the province. Much new territory was opened up by the Edmonton, Dunvegan and British Columbia Railway and the Alberta and Great Waterways Railway; these colonization lines are now jointly owned by the C.N.R. and the C.P.R., and in 1930 were being extended to the mouth of the Peace River.

**Education.** The educational system of the province is thorough and comprehensive. The local government makes efforts to ensure a liberal education to juveniles between the ages of six and 16, and each center of importance has its high school. The principal university is at Edmonton. Agricultural colleges are numerous.

**History.** When the British North American Act was passed in 1867, the province was part of the Northwest Territory. In 1880 the country west of Manitoba began to be invaded by the cattle kings who drove their stock across the border from Montana and established ranches in present-day Alberta. Bull trains and prairie schooners soon connected this region with Fort Benton, at the head of navigation on the Missouri River. In 1882 four provisional districts, Assiniboia, Saskatchewan, Alberta and Athabasca, were created, and six years later these districts were granted legislative assemblies. It was not until 1905, however, that the growth of population warranted the consolidation of these units and the provinces of Alberta and Saskatchewan were organized to comprise the same territory included in the four districts. By the Act of 1905 the dominion government retained control of the public lands, but in 1930, after many years of debate, the government gave the province control of its natural resources.

Alberta is named after the second daughter of Queen Victoria.

**ALBERTA, UNIVERSITY OF,** a coeducational and non-sectarian institution at Edmonton, Alberta, Canada, created in 1906 by act of the Provincial Legislature. There are laboratories for all scientific courses, a museum, an herbarium, a farm and agricultural experiment plots. The library contains 23,676 volumes. In 1930 there were 1,254 students, and a faculty of 171, headed by Pres. Robert Charles Wallace.

**ALBERT HALL, THE ROYAL,** a concert hall in London, England, on Kensington Road, overlook-

ing KENSINGTON GARDENS. Built in 1867-71 by Captain Francis Fowke, it is an oval-shaped structure, measuring 270 ft. by 240 ft., in the Italian Renaissance style. It seats approximately 10,000 people, and is used for concerts, balls, bazaars, political meetings, boxing matches and similar events.

**ALBERTI, LEONE BATTISTA** (1404-72), Italian poet and artist, was born in Venice, Feb. 18, 1404. He won distinction in poetry, painting, music, philosophy and architecture. As an architect he is best known as the designer of the Strozzi Palace and the façade of Santa Maria Novella, both at Florence, and for his *De re Aedificatoria*, 1485, an outstanding exposition of architectural design. Alberti died at Rome in 1472.

**ALBERT LEA**, a city and county seat of Freeborn Co., southern Minnesota, situated between Lake Albert Lea and Lake Fountain, 97 mi. southwest of St. Paul; it is served by four railroads. Farming, dairying and truck gardening are carried on in the vicinity. The chief industries of the city are meat-packing and manufacturing gas and electric appliances, stoves and barn equipment. In 1929 the retail trade reached \$7,612,013. Butter and incubator-hatched chickens are shipped all over the country. The two lakes and the country around them have been set aside as a game refuge by the state. Albert Miller Lea, a West Point man, explored this region for the United States Government about 1835. The town was founded in 1865. Pop. 1920, 8,056; 1930, 10,169.

**ALBERT MEMORIAL**, in the south of Kensington Gardens, London, was erected in 1872 by Queen Victoria in memory of her consort, Prince Albert of Saxe-Coburg-Gotha (1819-1861). Sir Gilbert Scott designed the monument which was constructed at a cost of £120,000, more than half the amount being contributed by the public. The monument rises 175 ft. in height and is decorated with statues and mosaics. The podium is ornamented with reliefs representing leading figures in the arts of music, painting, architecture and literature. Groups symbolizing commerce, manufacture, engineering, and agriculture are at each corner. Beneath a Gothic canopy, there is a large bronze-gilt figure, 15 ft. high, of Prince Albert.

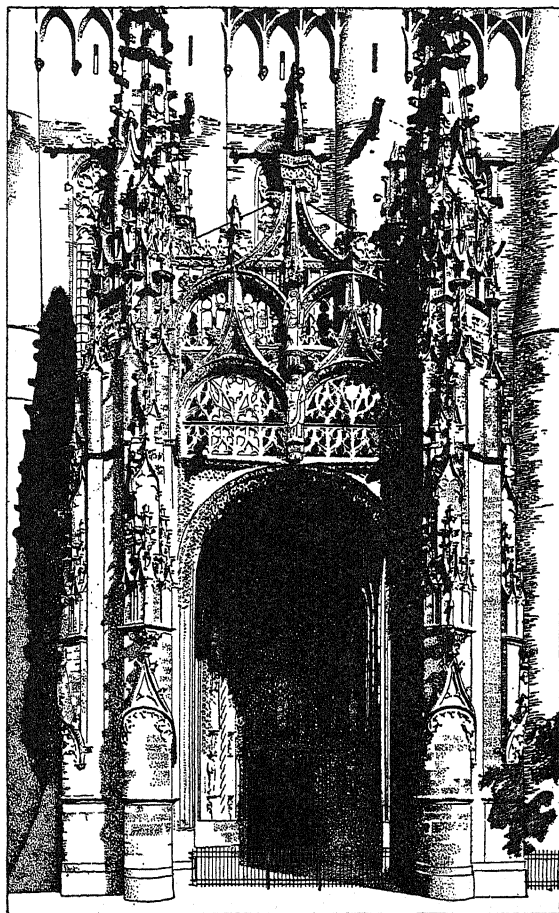
**ALBERT NYANZA**, a large lake of Uganda, in east central Africa, with an area of about 1,700 sq. mi. It lies at the head of the Great Rift Valley draining Lake Edward and Mount Ruwenzori by the Semliki River. The Nile provides a waterway between Lake Albert and Nimule. The Ituri district around the lake is inhabited by a relatively dense and vigorous native population, although disease takes a fairly large toll.

**ALBERTUS MAGNUS** (1206?-1280), German scholastic philosopher, was born at Lauingen, Suabia, about 1206. He is sometimes known as Albert of Cologne. In 1223 he joined the Dominican order. Much of his work was done at Cologne but he was in Paris from 1245 to 1248. He anticipated ROGER BACON and is known as a commentator on Aristotle.

Among his works are an incomplete *Summa* and a treatise against Averroës. He died at Cologne in 1280.

**ALBI**, an ancient and picturesque town in southwestern France, on the River Tarn. The town gave its name to the Albigensian heresy of the 12th and 13th centuries. It is now the capital of the department of the Tarn, and possesses flour mills, coal mines and factories. Pop. 1931, 29,351.

The Cathedral of St. Cecilia at Albi is a Gothic



SOUTH PORTAL OF THE CATHEDRAL OF ST. CECILIA, ALBI

edifice of unique construction, erected to serve the double purpose of fortress and church. The massive west tower, built entirely without openings in the lower part, preserves all the appearance of a military keep. It is 250 ft. high, and has four stories, the first three dating from about 1365, the fourth from the 15th century. The cathedral has neither transepts nor aisles, but lateral chapels are set between the heavy buttresses, and are lighted by high, narrow windows. The main body of the church is of brick, the plain outer walls being 130 ft. high. In marked contrast to the heavy, military effect of the structure as a whole is the elaborately carved south porch of white stone, built in the 15th century. The chief



glory of the rich interior is the rood screen erected in 1501, a marvelously delicate piece of lace-like sculpture, unsurpassed in its period. The ambulatory contains exquisitely carved statues of about the same date as the rood screen, 1473-1502. The stained glass is chiefly modern.

**ALBIGENSES**, a religious sect whose adherents spread during the 13th century throughout the south of France. They formed the largest branch of the CATHARS. The Albigenses believed in the existence of two opposing creators and natures eternally in conflict, while they denied the truth of the incarnation, death and resurrection of Christ. They condemned the procreation of children and praised death by suicide, their *endura*. Their social ideas were considered especially dangerous by their contemporaries. It has to be admitted, however, that the only accounts we have of their doctrines have come to us from their enemies and not through any members of the sect. Raymond VII, count of Toulouse, and his chief vassals, supported this cult; but Pope Innocent III, fearing the disruption of the Roman Church, undertook a crusade against it in 1209, with Simon IV de Montfort at its head. The sacking of Beziers, Narbonne, and Carcassonne marked its opening, the conquered territories being presented as a reward to Simon de Montfort who, however, was killed in 1218 at the siege of Toulouse. St. Dominic preached among the Albigenses from 1205-15. Louis VIII of France now entered the struggle against the partisans of the sect, the treaty of Meaux, 1229, terminating it in favor of the crown. It had assumed such proportions as to divide virtually northern and southern France; hence its extreme gravity to the unity of the French crown. Hunted and harassed on all sides, the sect finally died out through lack of continued support.

**ALBINO**, originally the name given by the Portuguese to the white Negroes of West Africa, but now used as a biological term to designate any unpigmented individual of a race normally pigmented. This deficiency in pigmentation is congenital, and when it occurs the skin is abnormally pale, the hair white or nearly so, and the iris is pink, rendering the eye exceedingly sensitive to light. Though but rarely found, albinos are met with in many races of men, and especially among the Indians of Mexico and the southwestern United States. Albinos occur among mice, rabbits and porcupines; also among birds, as peacocks; and among lobsters and other lower animals. In heredity albinism acts as a Mendelian recessive, so there are many more transmitters of the condition than actual albinos.

**ALBION**, the earliest designation of the British Isles, occurs in the writings of the 1st century A.D. and by some authorities has been restricted to Scotland. It is believed to be of Celtic origin, which belief has etymological basis in the words *alb* and *alp* (hence, also the Alps), meaning high or white mountain land, this being probably the first reference to the Dover cliffs. The name is still employed in poetical usage.

**ALBION**, a city in Calhoun Co. in southern Michigan, situated on the Kalamazoo River, 20 mi. west of Jackson. It is served by two railroads. The city is the seat of Albion College. Albion is a shipping center for the agricultural region, and manufactures malleable and gray iron castings; trucks, wire screens, and medical products. The city was settled in 1832 and chartered in 1885. Pop. 1920, 8,354; 1930, 8,324.

**ALBION COLLEGE**, at Albion, Mich., was chartered as Wesleyan Seminary in 1835. Women were admitted in 1849 and the name changed to Wesleyan Seminary and Female College. In 1861 the institution became Albion College. It is under the auspices of the Methodist Episcopal Church and has productive funds of \$1,718,389. There are 33,400 volumes in the library. In 1930 there were 867 students and a faculty of 55, headed by Pres. John L. Seaton.

**ALBITE**, a rock forming mineral belonging to the PLAGIOCLASE group of the FELDSPARS. It is usually white or slightly tinted bluish, gray or reddish, and varies from subtranslucent to transparent. Chemically albite is a sodium aluminum silicate, crystallizing in the TRICLINIC SYSTEM. It is a common constituent of a number of igneous and metamorphic rocks, especially the diorites. A MOONSTONE variety, showing bluish opalescence, is found in Switzerland and Elba, and is cut as a gem. *See also* PETROLOGY.

**ALBO, JOSEPH** (c. 1380-c. 1444), Spanish Jewish philosopher of religion, was born about 1380. He spent the later years of his life at Soria and died about 1444. Albo was a pupil of the philosopher HASDAI CRESCAS. He was one of the principal representatives of Judaism at the religious disputation of Tortosa, and was favorably inclined toward philosophy, despite his rigid adherence to rabbinic Judaism. His great work was the *Ikkharim*, or *Principles*, first printed in 1485, in which he asserted that the sole aim of man in this life was salvation, and that the life in this world was only a preparation for the higher life. This doctrine is admittedly of Christian origin, although the latter part of it is found expressed earlier in Jewish literature. Judaism to him is a discipline leading to eternal salvation. The Ten Commandments themselves are unalterable, but other legal and ritual prescriptions may be revoked. A. SH.

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**AL-BORAK**, an animal described in the Koran as carrying Mohammed to the Seventh Heaven. It had the face and voice of a man, wings of an eagle and body of a horse.

**ALBUMIN**, a name originally given to the chief constituent of the white of egg (here spelled "albumen"), but now applied to a subdivision of the general group of PROTEINS. These occur in all living matter including blood, and are especially abundant in those foodstuffs developed by animals and plants for the support of the early life of their progeny, as in milk, eggs, and seeds of plants. The albumins con-



stitute the simpler types of proteins, and contain some 15% nitrogen and very small amounts of sulphur and phosphorus. Their molecules are comparatively large, as a result of which their solutions in water are colloidal (*see* COLLOIDS). Application of heat, or the action of certain acids and alcohols, makes these large molecules unite and coagulate, precipitating out in the form of a rather elastic substance. The boiling of eggs, and the "searing" of meat depend upon this COAGULATION. When decomposed by hydrolysis or by the action of enzymes, the sulphur content of albumin makes its presence known through the production of the malodorous hydrogen sulphide.

**ALBUMINOIDS**, or sclero-proteins, that class of PROTEINS constituting the tougher parts of the bodies of animals, such as the keratin of hard, horny materials, the elastin of the yellow elastic tissue, the collagen of tendons, cartilaginous and bone tissues and the skin. They are practically insoluble in all liquids, and only upon continued gentle treatment with hot and slightly acidified water do they hydrolyze (*see* HYDROLYSIS), giving rise to such well known products as GLUE, GELATIN, and isinglass.

**ALBUMINURIA**, a condition in which albumin or other protein passes out of the blood, through the kidney into the urine. Normally this condition does not occur, only water, salts, and several other waste products being allowed to pass through the kidney. Albuminuria is indicative of damage of the kidney, though there is reason to believe that this need not be present.

The condition is often physiological and may follow hard muscular work, cold bathing, or eating foods rich in albumin. Compression of the renal vein, when the subject is lying down, may be responsible, so that albuminuria occurs only in urine secreted at night; or curvature of the spine may push forward the aorta, or draw upon the mesenteric artery, with the same result. This condition is called orthostatic or cyclic albuminuria, and may be present in any condition causing congestion of the blood supply of the kidney.

The most usual cause, however, is NEPHRITIS, or inflammation of the kidney. In fact, if other possible causes can be ruled out, albuminuria practically diagnoses the disease. Nephritis may be due to infection of the kidney or impairment of its function with advancing age.

Any condition, however, which injures the urine-secreting tissue will produce albuminuria. It is usual during fevers in which there is considerable tissue destruction, and disappears on subsidence of the fever. Drugs which injure tissue, as salts of lead, mercury, and arsenic cause the condition.

It is also associated with diseases of the blood, as purpura and anemia; diseases of the nervous system, as epilepsy and meningitis; as well as various other conditions.

Albuminuria, therefore, is not a disease, but a symptom. The importance of its presence depends upon the severity of the condition causing it. If in-

duced by fever, drugs, blood disease or congestion, it will disappear upon removal of the cause, provided too much damage has not been done to the kidney. If attending chronic kidney disease, it generally persists, but may be overcome.

The albumin may be detected chemically. If urine is allowed to come in contact with concentrated nitric acid, a white ring will form between the urine and acid when albumin is present. Making the urine acid with diluted acetic acid and heating it will, in presence of albumin, cause a white precipitate.

W. I. F.

**ALBUQUERQUE**, a city in northwestern central New Mexico, the county seat of Bernalillo Co., situated on the Rio Grande, 4,954 ft. above sea level, 56 mi. southwest of Santa Fé. The Santa Fé Railroad, airplanes and bus lines serve the city. The rainfall is very scant but the region is extensively irrigated, and produces poultry, livestock and diversified crops. Lumber, furniture and iron products are the local manufactures. In 1929 the factory output amounted to about \$7,000,000; the retail trade reached a total of \$21,106,039. The city is a health resort with sanatoria for tuberculosis patients and the seat of the state university and a government training school for Indian boys and girls. The old city was founded by Francisco Cuervo y Valdez in 1704. The new city was founded and incorporated in 1879. It was at this point that the Coronado expedition first crossed the Rio Grande in 1540. Pop. 1920, 15,157; 1930, 26,570.

**ALBURNUM**, the botanical term used to designate the soft outer layer or sapwood of a tree, in distinction to the hard durable inner portion known as heartwood or duramen.

**ALCAEUS**, one of the greatest of the Greek lyric poets, flourished about 600 B.C. It is thought that he was born at Mytilene, in Lesbos. Alcaeus originated the form of verse known as the Alcaic, which form HORACE transplanted into Latin. He was a contemporary and admirer of SAPPHO. For having supported the nobles against Pittacus in a civil war Alcaeus was banished, but was later pardoned.

**ALCHEMY**, an ancient body of learning and experiment seeking the constitution of matter, and centered upon the conversion of "baser" metals into gold. Though in part a study of nature, like the Greek analysis of matter into the four elements, earth, air, fire and water, it was pursued as a system of MAGIC and the speculations of OCCULTISM. It formed alliance with ASTROLOGY in that gold was the representative of the sun; silver, of the moon; iron, of Mars; and mercury, of the planet of the same name.

Alchemy sought the virtues and qualities of materials, which could be applied to human benefit. These were combined in the search for the PHILOSOPHER'S STONE, a substance with mystic-magical powers that could transmute lead into gold, cure disease, restore youth and prolong life. In medieval and later days the alchemist was the occult philosopher wielding black arts in his laboratory. Roger Bacon, about

1214-94, perhaps the most learned man of his day, was accused of such NECROMANCY; and the Dr. Faustus or *Faust* legend as dramatized by Goethe incorporated the traditional belief.

Alchemy, a word of Arabic origin, is associated with a mythical Egyptian deity corresponding to Hermes, from whose name we derive the term "hermetically sealed." One view of the origin of alchemy holds that it arose in connection with the art of dyeing and



THE ALCHEMIST

From an engraving by Martin Joachim Schmid

producing metallic lustres; which in turn led to the plating or bronzing of metals.

In the course of experimenting with such processes as fire, solution, evaporation and condensation, and with such substances as sulphur, mercury, salts and metals, the alchemists, seeking the secret of the composition of matter and its control by transmutation, came upon many important facts from which a science of chemistry was developed. But their search was equally for general secrets of nature, the quintessence, or fifth essence, beyond the four elements. Their procedures became more elaborate and fanciful, relying upon occult relations and formulae.

Moral concepts entered. Thus gold was pure, silver noble, tin and mercury intermediate, iron and lead base; and behind the substance was the spirit, a term surviving in "spirits of ammonia." The temptation

to fraud in the making of gold to gain the support of royal patrons led to such devices as crucibles with wax bottoms concealing particles of gold. At times the pretense of commuting gold was declared a felony. Yet such scholars of their day as Albertus Magnus, 1193?-1280, and Paracelsus, 1493-1541, a professor of physics at Basle, were at once alchemists and students of chemical and physical reactions. Such tales as that Albertus was able to produce summer or winter in his garden at will; or that Raymond Lully, c. 1235-1315, sought alchemy to cure his fair lady of cancer, indicate the service expected of this supernatural art.

Apart from the practical search for transmutation of metals, and elixirs of life, and general wonder-working powers, there was a serious if mythical side to the alchemist's pursuit, which is recognized in the history of chemistry. The scientific search for elementary relations by way of radioactivity suggests a modern alchemy as remote from the alchemist's conceptions as are the problems of modern astronomy from those of astrology. Chemistry arose as alchemy was abandoned. Alchemy remains an important antecedent of chemistry reflecting the magical, mystical and occult concepts that prevailed before the beginning of modern science. See also CHEMISTRY (History).

J. J.

**ALCIBIADES** (c. 450-404 B.C.), an Athenian statesman, wealthy, high-born, dissolute, yet supremely able. Losing his father at the age of three he became the ward of his kinsman PERICLES, who dominated Athens in her most glorious days. A pupil of Socrates, he admired, if he did not imitate, his master. Alcibiades took a prominent part in Athenian politics during the PELOPONNESIAN WAR and was largely responsible for the decision of Athens to send an expedition to Sicily, 415 B.C. Starting as one of the commanders of this expedition he was recalled to answer a charge of impiety. Disobedient to this summons he joined the Spartans, persuading them to defend Syracuse stoutly and to fortify a permanent base at Decelea, near Athens. Thus he contributed directly to the downfall of Athens. Soon he lost the confidence of the Spartans and took refuge with a Persian satrap Tissaphernes in 412 B.C. Taking advantage of party strife in Athens he entered the service of the democrats and won several naval victories over the Spartans near the Hellespont. In 407 B.C. he was enthusiastically welcomed in Athens and elected general with full powers. But failure led to his dismissal from command, whereupon he withdrew first to the Thracian Chersonese and later, after the defeat of Athens at Aegospotami, to Phrygia. Here he was murdered at the instigation of the Spartans.

G. M. H.

**ALCIPHRON**, Greek writer, who lived probably in the 2nd century A.D. He is noted for a collection of letters, written in pure Attic dialect, and about 120 in number. The author of these fictitious letters assumes the character of persons representing the various classes of Athenian people, by this means revealing many phases of life in the Greek communities.

**ALCMAEON** (6th century B.C.), Greek natural philosopher, reputed a pupil of Pythagoras. He believed the human soul was immortal, because it contained within itself a principle of motion such as is contained in the heavenly bodies. Alcmaeon is reputed to have been the first person to realize that medical and surgical information might be obtained by dissection of animals.

**ALCMAN** or **ALCMAEON** (7th cent. B.C.), Greek lyric poet, was born at Sardis in Asia Minor in the 7th century B.C. He lived most of his life in Sparta, where he taught the State choruses; his parthenic choruses were sung by the Spartan maidens. He held first place in the Alexandrian Canon. Alcman wrote love poems, hymns, paeans and prosodia or processions, only a few of which are extant. He originated Doric lyric poetry.

**ALCOA**, a city in southeastern Tennessee, in Blount Co., 15 mi. south of Knoxville, served by two railroads. Farming and lumbering are the chief interests of this region. The local manufactures are aluminum ingot, sheet and strong alloy, aluminum bronze powder, brick, floor tile and lumber products. The city is a short distance from Great Smoky National Park. Alcoa was incorporated in 1919 under commission-manager government. Pop. 1920, 3,358; 1930, 5,255.

**ALCOCK, SIR JOHN WILLIAM** (1892-1919), English aviator, was born at Manchester, Nov. 6, 1892. At the opening of the World War in 1914 he joined the Royal Naval air force and served at Mudros in the Aegean in 1916, at the bombing of Constantinople in 1917 and in British engagements in the Near East. When his engine failed, over Suvla Bay, after an expedition to Constantinople, Alcock landed safely on the water but was made prisoner by the Turks. On June 14-15, 1919, Alcock, with Lieut. Arthur Whitten Brown, safely flew from St. John's, New Brunswick, to Clifton, Ireland, in 16 hours, 12 minutes. For this flight Alcock was knighted. He was killed in a landing at Côte d'Evrard, Normandy, Dec. 18, 1919.

**ALCOCK, SIR RUTHERFORD** (1809-97), British diplomat and orientalist was born at Ealing in May, 1809. After an early career as a physician, he became consul at Foochow, China, in 1844, and two years later assumed charge of the British settlement at Shanghai. Sent as consul-general to Japan in 1858, the following year he was appointed minister plenipotentiary and remained at Tokyo despite the disorders of the following three years. Knighted in 1862, he was sent as minister to Peking (now Peiping) in 1865 and remained there until 1871. Upon his return to England he wrote several books upon Japanese life and art, including *Art and Art Industries in Japan*, 1878. An earlier work, *The Capital of the Tycoon*, 1863, was an exciting record of his experiences in Japan. He died at London, Nov. 2, 1897.

**ALCOFORADO, MARIANNA** (1640-1723), Portuguese nun and letter writer, was born at Beja in 1640. She became a Franciscan nun at 16 and at

25 was betrayed by Noel Bouton, a French soldier who later became a Marshal of France. Her fame rests on five love letters written to Bouton between 1667-68 after the betrayal. The letters, published anonymously in Paris in 1669, created a sensation in Europe. Rousseau asserted that the *Letters of a Portuguese Nun* were written by a man but they are now generally accepted as the outpourings of the heart of the betrayed girl, who died at Beja in 1723.

**ALCOHOL, INDUSTRIAL**, is prepared on a very large scale from all kinds of starchy substances, such as low-grade ("blackstrap") molasses from sugar refineries, corn, potatoes, and fruit waste from canneries. The first step is the conversion, by FERMENTATION, of the STARCH into sugar DEXTROSE, which process can be made quantitatively complete by the action of the enzyme diastase (*see* ENZYMES). By adding yeast to the sugar solution, the latter is then broken up, one molecule of dextrose yielding two molecules each of alcohol and carbon dioxide:  $C_6H_{12}O_6 = 2C_2H_5OH + 2CO_2$ .

The production of alcohol in the United States in recent years has averaged more than 100 million gallons annually. However, the synthetic process whereby it is made from ACETYLENE has not yet become commercially important, as this requires cheap electric power for the production of calcium carbide,  $CaC_2$  (*see* CALCIUM; CARBON) in order to obtain the acetylene. Nevertheless, it is possible that cheap electric power may make it profitable in future.

The usual commercial product is known as "grain alcohol" and contains about 95% of ethyl alcohol, or ETHANOL, although it may be further diluted for various purposes. Its actual concentration is expressed in percentage "proof," where PROOF SPIRIT in the United States contains 50% alcohol by volume at 15.6°C. Owing to its possible use as a beverage, commercial alcohol, as well as all beer, wines, and spirits, is heavily taxed and provides a great source of revenue to most governments of the world. Since its properties as a solvent and as a fuel, as well as its low cost of manufacture, make alcohol an exceedingly important industrial substance, it has become necessary to devise a means of lifting the high tax from the alcohol which is used solely for industrial purposes. This is accomplished by the addition of adulterants which usually render the product poisonous and presumably unfit as a beverage; it is then known as "denatured" alcohol. This was first done in England about 1855 and it has since been done by practically all nations. The adulterants generally used are methyl (wood) alcohol (*see* METHANOL), pyridine, benzene, kerosene, turpentine, camphor, naphthalene, acetone, castor oil and some aniline dyes (*see* DYES, SYNTHETIC), but they vary according to the use that is to be made of the denatured product. The United States has recently adopted an adulterant which is not poisonous but which renders one drinking the alcohol deathly sick.

The uses for alcohol are many and varied. It is a constituent of paints and varnishes, shellacs and lac-

quers, such as *Duco*, cleaning and polishing substances and ANTI-FREEZE SUBSTANCES, and it is employed in the manufacture of transparent soaps, explosives, artificial leather, oilcloth, aniline dyes and ether and other anesthetics. It is convenient as a fuel, since it burns with a smokeless flame and leaves no residue, and is extensively used in small cooking stoves and portable lamps equipped with gas mantles. By itself, it does not form a satisfactory motor fuel, but the recent success in making absolute alcohol available at low cost has resulted in the production of an excellent airplane engine fuel comprising a mixture of alcohol and gasoline or benzene. W. J. L.

**ALCOHOL, MEDICAL EFFECTS OF.** Alcohol is probably never truly life saving. That term must be reserved for such effects as are produced by diphtheria and scarlet fever antitoxin, by digitalis for heart disease, by arsphenamine for syphilis, by quinine for malaria, or by other remedies with specific action on the organisms that cause disease. Alcohol has, however, been included in the U. S. Pharmacopoeia for many years as one of the important drugs used in medicine. The main value of alcohol is its use in an emergency and as a temporary remedy in the crisis of pneumonia, for example, to stimulate the heart, for its depressant effect in producing sleep, and for its effect in producing a feeling of well-being, called euphoria.

It has been pointed out that unquestionably the form of alcohol given has a distinct effect on the organs of taste and smell, and the form and dilution have a definite effect on the ease with which the drug is tolerated by the stomach.

Elderly patients, convalescing from mild infections of the throat and lungs, such as colds, grippe, influenza, bronchitis, or bronchial pneumonia, are likely to be benefited by moderate doses of alcohol. They are usually depressed and miserable in mind and body, without appetite, and with a sense of prostration and weakness. The use of small doses of alcohol eases the miseries of the body, encourages the patient to eat, and helps in the establishment of recovery.

The chief use of alcohol as a food or as a source of energy has been in diabetes. It has been urged that the use of alcohol in the diet makes possible the giving of smaller amounts of insulin than would otherwise be the case.

In the book called *Useful Drugs*, published by the American Medical Association, it is pointed out that alcohol is used externally to harden and cleanse the skin, and internally as a narcotic, excessive doses depressing and paralyzing the central nervous system. Small doses produce euphoria, stimulate respiration, moderately dilate the blood-vessels and modify the circulation.

Regarding the breathing of the vapors of alcohol, *see* GASES AND ATMOSPHERES, INJURIOUS. M. F.

**ALCOHOLISM**, the condition produced by long-continued use of alcoholic beverages. For some years it has been the impression among physicians generally that a man becomes a chronic alcoholic not because

of any special qualities in alcohol creating a certain disease, but because of some qualities in the man himself which makes him want to drink because of the general effects of alcohol.

There are, however, detrimental physical effects which cause definite physical changes. The first physical changes produced are irritation of the entire alimentary canal, manifesting itself in loss of appetite, disorders of the stomach, constipation, and loss of weight. Later, and more subtle changes are fatty degeneration of the internal organs, weakening of the blood-vessels, and destruction of the cells of the liver and kidneys.

Accompanying these physical effects are changes in the nervous system. Among these are inordinate craving for alcohol, tremors, convulsions, epilepsy, intellectual and moral deterioration, insanity, and delirium tremens. That alcoholism is an extremely common accompaniment of insanity cannot be doubted, but whether it is frequently a cause of the condition is another matter.

The effect of alcoholism on offspring is a very controversial point. Well-conducted experiments of various types have led to varying results, so that it is impossible to draw general conclusions. (*See* CHILDREN, DISEASES OF: Prenatal Diseases.)

It has long been known that the alcoholic patient is unreliable and will try to deceive his relatives, his friends, and his doctor, when they try to ascertain just why he indulges in his tendency to alcoholic sprees or chronic tipping.

Among these patients are numerous instances of abnormality of personal adjustment to life and of personality. The forms of mental abnormality vary from shiftlessness and irresponsibility to feelings of inferiority, religious fanaticism and sexual disturbances.

The most significant factor found apparently is the fact that most of the patients show a complete lack of any downright concern over their weakness. There is indeed a lack of desire on the part of the alcoholic patient to get well so that the painfulness of his affliction is outbalanced in his own mind by his sense of comfort and well-being when he takes too much alcohol.

Thus it is difficult to effect any permanent cure in an alcoholic patient without substituting something, such as religion, art or love, for the alcohol, and which will take the place in the patient's ego of the effect that he gets from alcohol. This explains why the chronic drunkard does not want to get well, no matter how much he may protest that he does.

Apparently the person who is a chronic alcoholic is one who has a constitutional instability, who finds discord in the family in which he is raised. He is ill-adjusted to life, has no sense of responsibility and when, as he gets older and marries, he finds married life full of problems which are beyond his solution. Alcohol apparently brings him forgetfulness, stimulation, and mental relief that he does not get in other ways.

Obviously, the control of such a condition must be

basically psychological control and not merely an attempt to handle the condition from the physical side.

M. F.

**ALCOHOLS**, a large and important group of organic compounds which are derived from the aliphatic (*see* ALIPHATIC COMPOUNDS) or chain-series of HYDROCARBONS by substituting a hydroxyl or (OH) group for a hydrogen atom. Alcohols are classified as mono-, di- and tri-hydric alcohols, according to whether they contain one, two, or three hydroxyl groups; and they are further differentiated as primary alcohols, where the (OH) group is substituted for one of the hydrogen atoms at the end of a saturated chain; secondary alcohols, where the substitution has taken place in the middle; and tertiary alcohols, where the (OH) group is united to a carbon atom which has no further hydrogen attached (*see* CHEMISTRY, Organic). Thus, ethyl alcohol (*see* ETHANOL), the best known representative of the group, is a monohydric, primary alcohol, of formula  $\text{CH}_3\text{CH}_2\text{OH}$ ; iso-propyl alcohol (*see* ISO-COMPOUNDS),  $\text{CH}_3\text{CHOH.CH}_3$ , is a secondary alcohol; and GLYCERINE,  $\text{CH}_2\text{OH.CHOH.CH}_2\text{OH}$ , a trihydric alcohol.

The monohydric alcohols are in the majority in nature and they generally form colorless substances. The lower ones, such as methyl (*see* METHANOL), and ethyl (grain) alcohol (*see* ETHANOL) are highly volatile; the higher ones, such as cetyl and melissic alcohol, occurring in waxes and containing from 16 to 30 carbon atoms, are solid. When soluble in water, they are neutral in reaction, yet they are somewhat basic, since they form salt-like compounds with acids known as ESTERS. On the other hand, the hydrogen atom of the hydroxyl group is replaceable by an alkali metal, thus producing an alcoholate.

If water is extracted from an alcohol, an ETHER results. Upon oxidation, primary alcohols produce first ALDEHYDES and then ACIDS; secondary alcohols give rise first to KETONES, which upon further oxidation break up into two acids, and tertiary alcohols disintegrate immediately into ketones and acids. Addition of a hydroxyl group to a BENZENE nucleus results, not in an alcohol, but in a phenol (*see* PHENOLS) having acid properties. Only when a benzene nucleus is joined to a hydroxyl group, through an alkyl group as intermediary, does an aromatic alcohol result, as benzyl alcohol,  $\text{C}_6\text{H}_5\text{CH}_2\text{OH}$ . W. J. L.

**ALCOR**, a faint star of the fifth magnitude just visible to the naked eye closely adjoining MIZAR, the middle star of the handle of the Big Dipper. It is 70 light years distant and composed of two stars, each about 3 times as luminous as the sun. *See* STAR: map.

**ALCOTT, AMOS BRONSON** (1799-1888), American educator and philosopher, was born at Wolcott, Conn., Nov. 29, 1799. In 1828 he established the first of his many schools at Boston; but his unorthodox way of teaching and his criticism of noted persons caused him to discontinue each of these in turn. Many of the theories formulated by him have since been adopted by leading educators, such as the use of simple conversations with pupils. In 1842

Alcott tried the experiment of a utopian community in Fruitlands, near Harvard, Mass. Thereafter he devoted much of his time to lecturing, trying to expound his views on society, education and theology. He died at Boston, Mass., Mar. 4, 1888.

**ALCOTT, LOUISA MAY** (1832-88), American juvenile writer, was born at Germantown, Pa., Nov. 29, 1832. Her father was AMOS BRONSON ALCOTT, the New England philosopher, and when Louisa was two years old, the family returned to Massachusetts, living first in Boston and then in Concord. She had no formal schooling, but she had Emerson to direct her reading, Thoreau to reveal nature to her and Hawthorne to tell her stories. At 16, in order to aid in the support of the family, she began to teach kindergarten and to write stories, some of which were published in *The Atlantic Monthly*. Her first book, *Flower Fables*, appeared in 1854. Her experiences as a nurse during the early part of the Civil War resulted in *Hospital Sketches*, 1863. Her first novel, *Moods*, was published in 1864, but it was not until 1868, when *Little Women* was published, that she achieved recognition. *Jack and Jill*, *Little Men*, *Eight Cousins*, *Jo's Boys*, *Rose in Bloom*, *An Old Fashioned Girl* followed quickly, were well-received and are read still, but none of these equaled *Little Women* in popularity or merit. The author died in Boston, Mass., Mar. 6, 1888.

**ALCOY**, a city of Spain in the province of Alicante, built among gardens at the foot of the Sierra Mariola. It produces large quantities and varieties of paper, and cloth, cotton and flannel goods. Est. pop. 1929, 36,000.

**ALCUIN** or **FLACCUS ALBINUS** (c. 735-804), English educator and ecclesiastic, was born at or near London about 735. He was educated at the School of York and in 778 became head of the school. Three years later he was appointed by Charlemagne as the latter's educational adviser, and he conducted Charlemagne's palace school. In 796 he was made abbot of St. Martin's at Tours and founded a model monastic school, which led to the establishment of many others on the same plan. Alcuin's importance in education is due to his widespread influence rather than any new theories or educational reforms. He was the first of the great English educators. Alcuin died at Tours May 19, 804.

*See* West, *Alcuin and the Rise of Christian Schools*; C. J. B. Gaskoin, *Alcuin: His Life and His Work*, 1904.

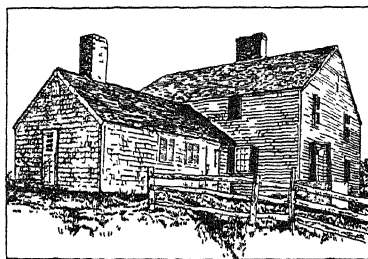
**ALDEBARAN** (*Alpha Tauri*), the brightest star of the constellation TAURUS, the Bull. The name is derived from the Arabic and means the follower; it follows the Pleiades in the sky. It is a yellow giant star 40 times larger in diameter than the sun, and 90 times as brilliant. Its distance is 57 light years and is receding from us with a speed of 34 miles per second. *See* STAR: map.

**ALDEHYDES**, organic compounds intermediate between ALCOHOLS and ACIDS, having the general formula  $\text{R.CHO}$ , where R is an aliphatic or aromatic radical. Aldehydes are obtainable by the oxidation

of primary alcohols, and are in turn transformed into acids upon further oxidation. The simplest representative, FORMALDEHYDE, has a pungent smell, and is best known, in water solution, as FORMALIN. It can be derived by oxidation of methyl alcohol (see METHANOL) and can be converted into FORMIC ACID upon further oxidation. The simplest aromatic aldehyde, BENZALDEHYDE, contributes the pleasant odor to oil of bitter almonds. Aldehydes are very active chemically, and their easy oxidation into the corresponding acids renders them useful reducing agents. They precipitate silver as a mirror-like deposit from an ammoniacal solution of silver nitrate; they polymerize easily and form more complex compounds which are not so reactive. Formaldehyde, whose formula,  $\text{HCHO}$ , shows it to be the simplest carbohydrate, actually has a sugar as its POLYMERIZATION product, and it is quite possible that formaldehyde is an intermediary in the PHOTOSYNTHESIS of plants, where starch and sugar are made from the carbon dioxide of the air with the liberation of oxygen.

**ALDEN, HENRY MILLS** (1836-1919), American author and editor, was born at Mount Tabor, Vt., Nov. 11, 1836. He was editor of *Harper's Weekly* in 1863 and became editor of *Harper's Magazine* in 1869. Among his works are *God in His World*, *A Study of Death* and *Magazine Writing and the New Literature*. Alden died at Metuchen, N.J., Oct. 7, 1919.

**ALDEN, JOHN** (1599-1687), one of the Pilgrims of Plymouth, Mass., was born in England in 1599. He came to America in the *Mayflower* in 1620 and was one of the signers of the Mayflower pact for the government of the colony. In the colony he served as a magistrate and in 1627 was one of the eight bondsmen assuming responsibility for the colonial debt. That year he moved to Duxbury, Mass., where he and Miles Standish arbitrated disputed claims of the In-



JOHN ALDEN'S HOUSE AT DUXBURY

dians and settlers. He married Priscilla Mullens, to whom, according to the Longfellow legend, he first proposed on behalf of Miles Standish. Eleven children were born to them. He died at Duxbury, Mass., Sept. 12, 1687.

**ALDER**, a genus (*Alnus*) of trees and shrubs of the birch family, natives of cold and temperate parts of the Northern Hemisphere and extending southward in the Andes to Peru and Bolivia. There are about 20 species; of these 9 are found in North Amer-

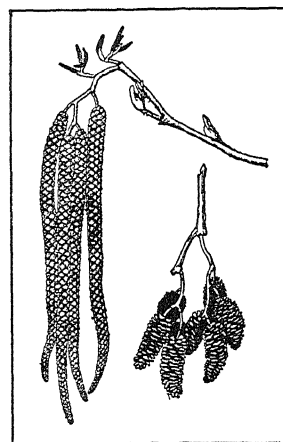
ica, 6 attaining the size of trees. The alders grow in swamps and river valleys and also on mountains, where at high altitudes they often constitute the most conspicuous part of the vegetation. They are among the first woody plants to grow in the stony rubble exposed by retreating glaciers or to spring up in areas denuded by avalanches. Alders are mostly small trees with astringent, scaly bark; oblong, pointed, sharply toothed leaves, which fall in autumn without change of color; male (staminate) flowers in pendulous catkins and female (pistillate) flowers in short, erect catkins; woody fruiting cones, which persist over winter, and very small, nutlike, usually winged seeds. The shrubby North American alders, all found in the eastern states and Canada, include the common speckled alder (*A. incana*), the smooth alder (*A. rugosa*) and the mountain alder (*A. crispa*). Of those growing to the size of trees only the seaside alder (*A. maritima*) occurs in the eastern states.

The others are found from the Rocky Mountains westward to California and northward to Alaska. The largest are the white alder (*A. rhombifolia*) and the red alder (*A. rubra*), attaining a height of 40 to 100 ft. and sparingly used for lumber. The black alder (*A. glutinosa*) of the Old World, naturalized in the eastern states, grows 30 to 60 ft. high with smooth bark and sticky leaves. The soft wood, which strongly resists decay in water, is used for piles, water pipes and pumps and also for charcoal.

A. B. J.

**ALDERMAN**, an Anglo-Saxon term meaning CHIEF or ELDER applied to the chief magistrate of a SHIRE. In modern usage it indicates a member of a city council or of the upper house of a bicameral council; a magistrate of a village or borough next in rank to the Mayor; a justice of the peace, as in Pennsylvania cities; sometimes a combination of the above functions. See also MUNICIPAL GOVERNMENT.

**ALDERNEY**, one of the British Channel Islands, situated in the English Channel  $8\frac{1}{2}$  mi. west of Cape La Hague, France, between which runs a strait, 9 mi. long, the Race of Alderney. The island is less than 4 mi. long, and its extreme breadth only  $1\frac{1}{2}$  mi. Its area is 3 sq. mi. The soil is extremely fertile, especially in the center of the island, and the breed of small cattle raised in Alderney and known by its name is far-famed among agriculturists. The climate is mild and sunny. An important trade is carried on in the export of early new potatoes, tomatoes and flowers to the English markets. St. Anne, the chief



FROM JEPSON MAN. FL. PLANTS CALIF., COPYRIGHT

RED ALDER  
Catkins and winter cones



town, is picturesquely situated in the center of the island. At certain spots there are indications of Roman and even prehistoric settlements. The population is French in origin, but the Channel Islands being in the possession of William of Normandy, fell under English sovereignty in 1066, when their possessor conquered that country. Although the official language is still French, English is in more common use in Alderney than in the other islands of the group. The inhabitants are exempt from any taxation by England. Pop. 1931, 1,506.

**ALDERSHOT**, a municipal borough of Hampshire, England, situated in open heath country intersected by the Basingstoke canal, 35 mi. southwest of London. Aldershot is entirely of military interest; camps were first established in 1855 and it grew steadily until the World War when it was greatly enlarged. In 1918-19 it became a great demobilization center, but its importance as a military camp has since waned. Pop. 1921, 28,764; 1931, 34,281.

**ALDRICH, NELSON WILMARTH** (1841-1915), American political leader and financier, was born at Foster, R.I., Nov. 6, 1841. He became a member of the Providence common council in 1869, and two years later was president of the council. He served in the Rhode Island legislature, 1875-76, was elected to Congress in 1878 and 1880, and entered the Senate in 1881. Outstanding in his political career during his 30 years in the Senate was his system of banking reform known as the Aldrich plan; the Aldrich-Vreeland Currency Law of 1908 and the Payne-Aldrich Tariff Act of 1909. Aldrich was also chairman of the national monetary commission in 1910. He died Apr. 16, 1915 in New York City.

**ALDRICH, THOMAS BAILEY** (1836-1907), American editor and writer, was born in Portsmouth, N.H., Nov. 11, 1836. As a child he read voluminously and before he was 12 had written a pirate tale, *Colenza*. The death of his father in 1854 prevented his entering college and he went to New York to become a clerk in his uncle's bank. He began to write poetry, worked on the staff of several New York publications, and in 1866 went to Boston to become the editor of *Every Saturday*. From 1881 until 1890 he edited *The Atlantic Monthly*. Aldrich published nine volumes of poetry, not including the four collected editions of 1865, 1882, 1897 and 1900, three novels, several books of travel, a tragedy in blank verse, and a number of short stories. His *Story of a Bad Boy*, 1870, an autobiography of his early life, is still popular, as is also his *Marjorie Daw and Other People*, 1873. He died in Boston, Mass., Mar. 19, 1907.

**ALDRICH-VREELAND ACT**, 1908, an emergency measure of the U.S. Congress intended to correct the inelasticity of credit and other defects of the monetary system made evident by the panic of 1907. The act permitted national banking associations to use as security for banknote issues not only U.S. bonds but other securities acceptable to the Treasury Department; authorized the issuance of banknotes to the value of 100% instead of 95% of the

bonds deposited with the Treasury; permitted national banks to organize in small communities with a capital as low as \$25,000; and created a commission, representing both congressmen and bankers, to make a thorough study of the situation. This commission's plan for a central banking system was rejected, but the ultimate outcome was the Federal Reserve Act of 1913.

**ALE**, a beverage obtained from the alcoholic fermentation of malted grain. There are several varieties, as pale ale, bitter ale and stock ale. A distinction is occasionally made between ale and beer, the name ale being used for malted liquor containing no hops, but the terms are often used interchangeably, except that Lager beer, stout and porter are not referred to as ale.

**ALEANDRO, GIROLAMO** (1480-1542), an Italian cardinal and scholar, born at Motta, Feb. 13, 1480. He lectured at the University of Paris and later was made rector. Aleandro was papal nuncio at the court of Charles V in Germany. He was papal representative in the opposition to Luther at the Diet of Worms, and on many missions against the Reformation. He was responsible for the burning of two monks at Brussels, who were the first to suffer for the Reformation. In 1536 he was made a cardinal. Aleandro died at Rome in 1542.

**ALEMAN, LOUIS** (c. 1380-1450), French cardinal, was born at the Castle of Arrent, near Bugéy, about 1380. He was made the Bishop of Maguelonne in 1418, Archbishop of Arles in 1423 and cardinal priest of St. Cecilia in 1426. Pope Eugenius IV deprived him of his ecclesiastical offices because he supported the antipope Felix V, but Pope Nicholas V restored him. He retired to Arles, and died in 1450.

**ALEMAN, MATEO** (1547-1610<sup>?</sup>), Spanish novelist, was born in 1547 at Seville. He is noted for his picaresque novel, *Guzman de Alfarache*, published 1599-1604. A masterly delineation of manners, this work ranks high in the purity of its style and was important in the development of the PICARESQUE NOVEL. It is thought that Aleman died in 1610 in Mexico, whither he had emigrated in 1608.

**ALEMBERT, JEAN LE ROND D'** (1717-83), a French mathematician and author, was born at Paris, Nov. 16, 1717. Among his more important scientific works are his *Treatise on Dynamics*, which founded a new principle in mechanical philosophy; *Theory of the Winds*, which gained the prize of the Academy of Berlin in 1746 and which contains the first conception and use of the calculus of partial differences; a treatise on the *Procession of the Equinoxes*, giving for the first time an analytical solution of the nutation of the earth's axis; and *Essay on the Resistance of Fluids*. He also wrote a great many philosophical works. Alembert died at Paris, Oct. 29, 1783.

**ALEPPO**, a city of Syria, situated on the River Keoik, in a large hollow surrounded by rocky, limestone hills, about 75 mi. east of the Mediterranean. The houses are built of stone, usually of one story,



surrounded by attractive courts; the streets are well paved. The older section of the city is enclosed by the ruins of a wall, 3 mi. in circuit, with seven gates. On a high mound stands the citadel, and at its foot a palace and a few domed mosques; the whole being a nearer approach to the Westerner's idea of the East than the visitor to Eastern towns can usually dare to hope for. During the World War the city was the headquarters of the commander-in-chief of the Turkish armies, and was captured by the British in Oct. 1918. Aleppo has a large local trade in cotton and silk goods, tobacco, wine and oil. Carpets, clocks and soap are manufactured. Its importance in foreign trade was greatly diminished by the opening of the Suez Canal. Pop. 1929, 177,313.

**ALÈS**, formerly spelled Alais, an industrial city in the department of Gard, southern France, situated at the foot of the Cévennes on the River Gardon. In the 16th century the town was a Huguenot stronghold. Here PASTEUR made his studies of the silkworm which were of vital importance to the silk culture of France. Besides its silks, markets and silk mills, Alès has coal, brick, glass, tile and other industries. Pop. 1931, 23,248.

**ALESIA**, an ancient town of Gaul, probably the modern town of Alise-Ste-Reine, in the department of Côte d'Or, France. It was built on a hill called Alesia which is identified with the modern Mont Auxois near Dijon, France. The place is famous as the last stronghold of VERGINGETORIX during the conquest of Gaul. At the end of 53 B.C., when Caesar had returned to Italy, the Gauls, led by Vercingetorix, started a widespread uprising. Caesar came back to Gaul but was unsuccessful in his siege of Gergovia, Vercingetorix's native town, near the modern Clermont-Ferrand, and started south to reach his base of supplies. Taken by surprise before reaching his destination, Caesar drove off the Gauls, and forced Vercingetorix to take refuge in his camp at Alesia. Caesar laid siege here, making his lines of defense so impregnable that reinforcements could not get through to the besieged nor could Vercingetorix find an exit. He was forced to surrender. This marked the last important revolt in Gaul against Rome. Alesia was destroyed by the Normans in the 9th century. Napoleon III erected a statue of Vercingetorix on the site. Excavations carried on in the 20th century confirm the historical importance of the site.

**ALESSANDRI, ARTURO** (1868- ), Chilean President, was born in 1868. He was elected a member of the Chamber of Deputies in 1897, and the following year at the age of 30 became Minister of Industry and Public Works, and later Minister of Finance and Minister of Interior. In 1920 he was elected President of the republic by a Liberal coalition representing middle class and labor interests. The shortcomings of his administration led to a *coup d'état* in Sept. 1924, which forced him to take leave of absence abroad and later to retire from office. He went to Italy, but another *coup d'état* in Jan. 1925 recalled him to the active Presidency. In September

of the same year, after a reform of the Constitution, he retired again, leaving Ramon Barros Borgoño as provisional President. Exiled by President Ibáñez, he returned to Chile after the Revolution of July 1931 and was defeated as a candidate for the Presidency in the election of the following October.

**ALESSANDRIA**, a city of Italy, capital of the province of the same name, situated on the Tanaro River. It is, next to Turin, the largest city in Piedmont, and is one of the most strongly fortified cities in Italy. It is also an important railroad center and a busy industrial city with well-attended fairs. Alessandria is the seat of a bishopric, whose ancient Cathedral of St. Peter was demolished by the French in 1805. A new cathedral was erected on its site in the latter part of the 19th century. Other churches are S. Rocco and S. Maria di Castello. Among the secular buildings the municipal palace and the Ghilini palace are noteworthy. The city dates from the Middle Ages. The enemies of Emperor Frederick Barbarossa caused the lords of Rovereto to establish a settlement about Castello Rovereto, to which Pope Alexander III gave his name. It was an independent city republic until 1522, when it became part of the duchy of Milan and later of Sardinia. It was occupied several times. The people are mainly engaged in the manufacture of furniture, machinery and hats. Pop. with suburbs, 1931, 82,567.

**ALESUND** or **AALESUND**, an important harbor and trade center of Norway situated on two islands off the west coast at the outflow of the Stor Fjord. A city since 1848, it has flourished chiefly because of its fisheries. In 1904 the entire city, consisting of frame buildings, was burned down and rebuilt in stone at the expense of the German emperor, William II. Pop. 1930, 18,373.

**ALEURITES**, a small genus of the spurge family comprising four valuable trees native to eastern Asia and the Pacific Islands, including the candlenut, the China Wood Oil Tree and the Tung oil tree.

**ALEUT**, an Eskimoan group inhabiting the Aleutian Islands and the northern side of the Alaskan peninsula. Their name is said to have been derived from the Chukchee word *aliat*, meaning island, the Russian explorers of Kamchatka having heard from the Chukchee of these islanders, or *aliuit*, beyond their shores. The Aleut call themselves *Unungun*, meaning people. Linguistically they form two divisions: the Unalaskans and the Atkans. The former live on the Fox Islands, the western portion of the Alaskan peninsula and the Shumagin Islands; the latter occupy Adreanof, Rat and Near islands. Early in the 17th century the Aleut were subjugated by the Russian conquerors by whom they were held in a condition of virtual slavery until the interference of the Russian government during 1794-1818. Early in the 19th century, under the leadership of the missionary Veniaminoff, the Aleut were converted to Greek Catholicism and were in some measure educated. In 1867, with the purchase of Alaska, they came under the jurisdiction of the United States.

Culturally they seem in aboriginal days to have possessed elements of both the historic Eskimo and Northwest Coast complexes, as evidenced by excavations made in shell-heaps and house sites by Dall and Jochelson and the finds of the Stoll-McCracken Expedition. These and other investigations have demonstrated that although Aleut culture contained many typical Eskimo traits, the Aleut, both physically and culturally, are more closely affiliated with the peoples of the American North Pacific Coast than with the Eskimo or the Asiatic Coast tribes.

**ALEUTIAN ISLANDS**, a chain of about 150 small islands belonging to the United States, and included in Alaskan boundaries; they separate Bering Sea from the northern part of the Pacific Ocean, and extend about 1,250 mi.; total area 6,391 sq. mi. The islands are of volcanic formation, and in a number of them there are volcanoes still in activity. The islands present a peculiar exception to the general coast topography of the rest of the continent. They furnish an example of a rugged mountain range that has been partially submerged at a comparatively recent date. The rocks in many places descend precipitously into deep water, leaving no room for the formation of beaches, and hence the waves to a great extent are without tools with which to cut away the land. Although the general appearance of the group is dismal and barren, yet there are grassy valleys capable of supporting cattle throughout the year, and potatoes, turnips and other vegetables are successfully cultivated. Fur farming and fishing are important industries. The natives, known as Aleuts, belong ethnographically to the same stock as those found in Kamchatka. The largest islands, Unimak and Unalaska, were discovered by V. J. BERING in 1741. Pop. 1920, 1,080; 1930, 1,116.

**ALEWIFE** (*Pomolobus pseudoharengus*), a North American fish called herring in the market and closely allied to the true HERRING. It is from 8 to 10 in. long; bluish in color with silvery sides, and has indistinct black stripes along the rows of scales. The body is rather deep and compressed; the head short and the eyes very large. The alewife is very abundant along the Atlantic coast from the St. Lawrence to the Carolinas. It is found also, much dwarfed in size, in Lake Ontario and in certain small lakes tributary to the St. Lawrence. The alewife lays from 60,000 to 100,000 eggs at one time, but most of these are devoured before they hatch. It is anadromous, ascending from the sea to rivers to spawn, and is the most important American food fish of this type, next to the shad and the salmon.

In 1929 the total commercial catch of alewives in United States waters, taken mostly in Chesapeake Bay and on the south Atlantic coast, amounted to 35,290,000 lbs., with a value of \$434,000.

**ALEXANDER**, name of eight popes. St. Alexander I, according to later tradition bishop of Rome, 106-115, died a martyr's death. Alexander II, 1061-73, an ardent protagonist of the Cluny reform, was an Italian elected through the influence of HILDE-

BRAND, whose domination caused him to reform the Church and free it from the secular power. Alexander III, 1159-81, was one of the most prominent popes of the Middle Ages who, despite great opposition, during his long pontificate advanced the power of the papacy, imposed penance upon Henry II of England for the murder of Thomas à Becket, humbled Frederick Barbarossa, and entered Rome with the glory of a conqueror. Alexander IV, 1254-61, nephew of Gregory IX, was proud but inefficient. Humbled by Manfred of Sicily and deserted by the bishops, he fled from Rome and died. Alexander V, 1409-10, was elected by the Council of Pisa but not generally recognized. Alexander VI, 1492-1503, was Rodrigo Borgia. (See BORGIA, FAMILY.) Alexander VII, 1655-67, a Chigi, envoy of the papacy to the conference at Münster, 1648, which led to the Treaty of Westphalia. He did much to restore the beauties of Rome. Alexander VIII, 1689-91, recovered Avignon and Venaissin from Louis XIV.

**ALEXANDER I** (1777-1825), czar of Russia, was born at St. Petersburg (Leningrad) Dec. 23, 1777, the son of Paul I and his second wife, Maria of Wurttemberg. He ascended the throne on Mar. 24, 1801, upon the death of his father who was murdered. In 1805 he joined the alliance against Napoleon, but after his armies were successively defeated at Austerlitz and Eylau in 1806 and at Friedland in 1807 he made peace with the French Emperor at Tilsit in 1807 and became his ally against England. By 1811 his friendship for Napoleon had cooled and Russia began to resume trade relations with Great Britain. Napoleon declared war, but his attempt to coerce Alexander ended in the great military tragedy of 1812 in which the burning of Moscow forced the retreat and destruction of Napoleon's army. Thenceforward the czar continued the leader of the European sovereigns in the war against Napoleon and in the reconstruction of Europe that followed. Idealistic and of a romantic nature he was considerably influenced by the liberal and religious thought of the late 18th century which led him to inaugurate numerous reforms in Russia, grant a liberal constitution to the newly organized kingdom of Poland in 1815 and secured the acceptance of the HOLY ALLIANCE. During his reign Russia acquired Finland, Bessarabia and the Duchy of Warsaw. He died, Dec. 1, 1825.

**ALEXANDER II** (1818-81), czar of Russia, son of Nicholas I and Alexandra, daughter of Frederick William III of Prussia, was born Apr. 29, 1818. Upon the death of his father at the end of the Crimean War, in which Russia's advance in the Near East at the expense of Turkey received a severe setback, he succeeded to the throne, Mar. 2, 1855. Twenty years later the attempt at the power of Turkey was more successful, although the Russian control of the Balkans which Alexander II would have set up by the Treaty of San Stefano (1878) was blocked by the Powers. He remained neutral in the Franco-Prussian War and in 1872 joined with Germany and

Austria in the League of the Three Emperors, dissolved by his son. He was known in Russia as the "Czar Liberator" because of the emancipation of the peasantry in 1861, and his reforms in local government and the administration of justice. He was planning further reforms and the proclamation of a constitutional charter for Russia when he was killed by a Nihilist's bomb at St. Petersburg, Mar. 13, 1881.

**ALEXANDER III** (1845-94), czar of Russia, was born Mar. 10, 1845, the second son of Alexander II and Princess Marie of Hesse-Darmstadt. After the death of his elder brother, Nicholas, in 1865, he became heir to the throne, and in 1866 married Princess Dagmar of Denmark, and on the assassination of his father on Mar. 13, 1881, he became Czar. He let it be known immediately that he would make no concessions to liberalism, and during the 15 years of his reign he did everything he could to keep western ideas of government and of social order out of Russia. Under the guidance of the reactionary *Pobiedonostsev* he inaugurated the policy of Russification towards all non-Russian elements of the population, especially the Finns and Poles. Jews were subjected to bitter persecution. To carry out this policy, a secret department of the police was created, rigorous censorship of the press was set up, and all liberal revolutionary movements were cruelly persecuted. In foreign affairs Alexander gradually broke away from Germany and during the last four years of his reign he entered into close alliance with France, on the basis of which the Entente Cordiale was later developed. He died at Livadia, Nov. 1, 1894.

**ALEXANDER, JOHN WHITE** (1856-1915), American painter, was born at Allegheny, Pa., Oct. 7, 1856. Circumstances forced him to earn his livelihood at 12, and he became a telegraph boy in Pittsburgh. His artistic career began at 18 in the art department of Harper & Bros., where he remained for three years. There followed four years of study in the leading art centers of Europe, Alexander profiting greatly from lessons under Frank Duveneck and from his association with Whistler in Venice. On returning to New York in 1881 he quickly achieved a reputation. He was especially happy in portraiture and in the picturesque treatment of women in subject painting. Honors crowded upon him. In 1893 he was elected to the Société Nationale des Beaux Arts. He served for several years as president of the National Academy of Design, and was elected to membership in most of the important art associations here and abroad. He is represented in the Luxembourg by *The Green Bow*; the Metropolitan has *The Ring* and his *Study in Black and Green*; in the Carnegie Institute is *La Femme Rose*; and the Boston Museum has the frequently copied *Pot of Basil*. The long list of his portraits includes Grover Cleveland, Henry Van Dyke, R. L. Stevenson, Rodin and Walt Whitman. His finest murals are *The Evolution of the Book* in the Congressional Library and *The Crowning of Labor* in the Carnegie Institute, Pittsburgh. Alexander died in New York City, June 1, 1915.

**ALEXANDER COLUMN**, a memorial in the Uritsky Square, Leningrad (formerly Palace Square, St. Petersburg). It is 98.4 ft. high and consists of a monolith of polished red Finnish granite surmounted by the bronze figure of an angel bearing a cross in his left hand and pointing with the right toward the sky, while his foot tramples on a snake. The sculpture was done by Ostrovsky. The column was erected by Montferrand and dedicated to Alexander I, emperor of Russia, 1801-25.

**ALEXANDERS** (*Smyrnum Olusatrum*), a stout, strongly aromatic biennial, native to Mediterranean countries. In Europe it was once the most extensively cultivated of the vegetables belonging to the parsley family. For some 1,500 years this plant was very widely used as a salad and a pot herb, both the root and the blanched leaf-stalks being eaten. Theophrastus (372-287 B.C.) mentioned its medicinal properties, Dioscorides (c. 100 A.D.) described its usefulness, and Charlemagne (742-814) ordered it planted on his farms. Since about 1800 the cultivation of alexanders seems to have been completely abandoned in favor of CELERY, which is more delicately flavored.

**ALEXANDER THE GREAT** (356-323 B.C.), King of Macedon and conqueror of the Persian Empire, was born in 356 B.C. He was the son of PHILIP II and Olympias. The education of the young prince from the age of 13 was entrusted to ARISTOTLE. At 18 he withstood successfully the Sacred Band of Thebes at the BATTLE OF CHAERONEA. Two years later, on the assassination of Philip, he ascended the throne of Macedon. His father had lifted the kingdom to supremacy over the Greek states and had prepared an expedition against Persia. Alexander moved promptly to secure his frontiers in Thrace and Illyria, suppressed a rebellion in Thebes, and in 334 B.C. crossed the Hellespont as commander-in-chief of an expeditionary force of Macedonians and Greeks against DARIUS III, King of Persia. Fighting at the head of his army, he defeated a larger force of the enemy at the River Granicus, thus winning the mastery of Asia Minor. In 333 B.C. Syria was opened to him after his crushing victory at Issus where the Persian monarch commanded in person. Alexander now determined to close every port in the eastern Mediterranean to the Persian fleet before pursuing Darius into the heart of the empire. Tyre and Gaza resisted vigorously but fell before the matchless strategy of Alexander and the ingenious siege devices of the Greek engineers on his staff. His next objective was Egypt, restive for years under Persian rule. The royal garrison was helpless. The natives welcomed Alexander as a deliverer. While in Egypt he founded the city of Alexandria near the Canopic mouth of the Nile. He also visited the revered oracle of Ammon, far to the west in the desert, where he was hailed as the son of ZEUS.

Alexander had detached Asia Minor, Syria and Egypt from the Persian Crown. He had rendered impotent the imperial fleet. He had been acclaimed the son of a god. Now he felt prepared to lead his

army against the eastern strongholds of the Great King. In the spring of 331 B.C. he appeared again in Syria and advanced across the Euphrates and Tigris. On Oct. 1 of that year he fought his decisive battle against Darius near the village of Gaugamela. Although the Persian resistance was brave and stubborn, Alexander won. Darius fled to the east and was slain by his own subjects. Meanwhile, the conqueror invaded Babylon without a struggle and moved on to Persepolis, Susa and Pasargadae, centers of imperial authority. Enormous treasures of silver fell into his hands. Not content with these dazzling victories, Alexander resolved to destroy every vestige of Persian rule in the Iranian lands still farther to the east. This project cost him dearly in man power but in no wise slaked his thirst for conquest. He invaded northern India in 327 B.C. and would have undertaken the systematic occupation of the whole of that country but for the veto interposed by his war weary troops. At their demand he made his way down the valley of the Indus River. From the mouth of the river he ordered a fleet under his admiral NEARCHUS to follow the coast line westward through the Arabian Sea to the head of the Persian Gulf. He himself led his army across the Gedrosian desert. The casualties from heat, hunger and exhaustion were appalling.

On his return to Mesopotamia and Persia Alexander became engrossed in the problems of imperial organization. His extraordinary position as King of Macedon, president of the Greek League of Corinth, and successor to Darius III created serious political complications. Throughout much of the East royal authority was associated with the acknowledged divinity of the monarch. Such ideology was repugnant to Greek and Macedonian thought. Alexander adopted the Oriental formula of the distress of the army and the consternation of the civil population in Greece and Macedon. Furthermore, he attempted an assimilation of his officers and soldiers with the Persians so that a new race of rulers might be raised up for his world state. Before any solution of these problems was found, Alexander was stricken with fever at Babylon in June 323 B.C., and died.

His empire was divided soon after his death; but the fame and influence of the conqueror endured. Measured by the extent of his military successes he was the greatest general of the ancient world. Considered as a propagator of Hellenism he assured the triumph of that civilization throughout the eastern Mediterranean basin and evoked the vitality that made the Greek spirit irresistible in the West. He planted Greek cities along the path of his conquests. He opened Egypt, Syria and Mesopotamia to Greek commercial enterprise and Greek cultural domination. At the same time he exposed the Hellenic world to Oriental ideas particularly in the fields of religion and political theory. The interplay of these rival cultures established the main lines of historical development during the succeeding six centuries.

The immediate political results of his career were twofold. He eliminated the danger of further Oriental

encroachments on the integrity of the Greek states. However, his military success foredoomed to failure all efforts to restore the autonomy of these states. They passed permanently under the suzerainty first of Macedon and later of Rome. The most daring political concept of Alexander was that of a world state, enjoying a common civilization and ruled by the single hand of a benevolent autocrat. None of his successors was able to impose this system upon society. But the idea persisted and came to fruition with the founding of the Roman Empire.

Finally, Alexander was a heroic personality as well as a creative influence in history. The beauty of his person, the charm of his manner, and the romantic fire of his soul made him the idol of his companions and stirred profoundly the imagination of the world. He passed into the popular legends of every land where he set foot. Islam as well as Europe told his story in the Middle Ages.

S. T.

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**ALEXANDRA** (1844-1925), Queen of Great Britain, wife of Edward VII and mother of George V, was born Dec. 1, 1844. She was the eldest daughter of Christian IX of Denmark. Her sister Dagmar was married to the Tzar Alexander III of Russia, being known as the Empress Marie, and mother of the unfortunate Nicholas II who was killed at Ekaterinburg. Her brother Wilhelm became George I, King of the Hellenes and father of King Constantine. Alexandra herself was married on Mar. 10, 1863, to Albert Edward, Prince of Wales. The "sea-king's daughter from over the sea" to quote Tennyson's greeting was among the loveliest women of her time; her taste in dress influenced the fashions of her day. In this respect she was a contrast to Queen Victoria. Even her slight lameness was imitated as "the Alexandra limp." On Jan. 22, 1901, Edward VII ascended the throne and Alexandra shared his coronation. Devoted to her home, her children, her garden, and to animals, she took no part in public affairs. The Danish Royal Family is celebrated for its long life and Alexandra attained to her eightieth birthday, dying Nov. 20, 1925. She is buried with King Edward in St. George's Chapel, Windsor.

**ALEXANDRETTA**, a city of Syria, capital of the sanjak of the same name, situated on the Gulf of Alexandretta. The Suez Canal now takes care of much traffic from Persia and India which formerly came through Alexandretta but it is still the chief port of the Aleppo region. It is on a branch of the Baghdad railroad. Articles of export include tobacco, citrus fruits, silk cocoons, nuts, textiles and olives. Hides, woollens, dyes and silk are imported. The town was founded and named in honor of Alexander the Great who defeated the Persians in 333 B.C. The Turks, who held Alexandretta for many years, called it Iskanderun. Pop. 1929, 13,997.

**ALEXANDRIA**, the chief seaport of Egypt, situated at the point where the western or Canopic branch of the Nile enters the Mediterranean from the

Delta. The population of the city and suburbs was 570,314 in 1927.

The original town, surviving in its pottery and porcelain, famous for their inscriptions, was called Naucratis; but in 332 B.C., Alexander the Great, after subduing Egypt, laid the plan of the great metropolis which bears his name. Alexander departed for the east, but died before he could return to Alexandria, where he is supposed to have been buried. Over his traditional tomb the Moslems erected a mosque which was long venerated. The development of Alexandria, greatly assisted by the ruin of Tyre, was undertaken by the viceroy, Cleomenes, and within a century the new seaport had surpassed Carthage. According to an estimate by Diodorus Siculus, the population of free citizens, 58 B.C., was 300,000, a number which would be more than doubled if the slave population was added. The length of the city was 4 mi. and its circumference 15 mi. The port dues in 63 B.C. reached 6,250 talents, a figure which, in Roman money, amounted to about \$3,000,000, or perhaps much more. Under the Ptolemies Alexandria became a city second only to Rome; gradually, however, her independence as a Greek possession was undermined and in 80 B.C. Ptolemy Alexander bequeathed the city to the Roman Senate. It was in Alexandria that Julius Caesar and Mark Antony met Cleopatra. The infamous Emperor Caracalla visited Alexandria in 215 A.D., and, to revenge popular raileries against himself, ordered a general massacre which he watched from the temple of Serapis. In 296 Diocletian subjected Alexandria to a siege of eight months and inflicted severe penalties for the city's contumacy. The so-called Pompey's Pillar, 90 ft. high and still a landmark, was erected to commemorate this punitive discipline. For several centuries Alexandria was the greatest of Jewish cities. Here the Septuagint version of the Hebrew scriptures was prepared and here lived the Judeo-Christian teacher, Apollos. The Alexandrine Church became of great importance (*see* ARIUS; ATHANASIUS, Sr.) but during the 3rd century the decline of the city began. It was captured in 616 by Chosroes II, king of Persia, and in 640 the Arabians, led by Amrou, besieged the city for 14 months. With its open sea front, it could have been relieved by the Romans, but the Emperor Heraclius failed to send a single ship. The city fell, and if one is to believe Amrou's reports, contained at that time 4,000 palaces, 4,000 public baths, 400 theatres, 40,000 Jews who paid tribute, and 12,000 persons who sold herbs. According to tradition, Amrou inquired of the Caliph Omar what he should do with the famous library. Omar replied that if the Greek writings agreed with the Koran, they were superfluous; that if they disagreed, they were pernicious. In either event they were to be destroyed. For six months the baths were heated by the flames. According to Gibbon, however, many books already had perished in previous upheavals. With the rise of Cairo and the opening of trade routes in the Pacific and Atlantic, the decline of Alexandria

continued, until the population fell as low as 4,000. In 1801 French troops stormed the city, but after a battle in which Sir Ralph Abercrombie, 1734-1801, lost his life, were driven out by the British.

In the 19th century, a new Alexandria was created by Mehemet Ali, who reopened the Mahmudiya Canal to the Nile. The railway connecting Alexandria with Cairo was finished in 1856. Riots in the city led to its bombardment by the British fleet in 1882. To-day the city is prosperous and cosmopolitan. It lies for the most part between the sea and Lake Mareotis, and includes the island of Pharos which is connected with the mainland by a mole, now broadened by the silting of sand. Owing to new building, antiquities are for the most part almost inaccessible. Little is left of the museum, stadium and other old structures. The catacombs are very extensive.

**ALEXANDRIA**, a city in central Louisiana, the capital of Rapides Parish, situated on the Red River, 193 mi. northwest of New Orleans. The city has barge line, bus and airplane connections and is also served by five railroads. Alexandria is an important commercial and industrial center having more than 100 factories and mills. In 1929 the manufactures reached approximately \$4,000,000; the retail trade amounted to \$12,756,822. Lumber and lumber products are the chief manufactures; cotton, corn, sugar cane and potatoes are among the principal crops. Alexandria is the seat of Louisiana College. It was founded in 1785 on a Spanish grant, was incorporated in 1818 and the city was chartered in 1882. The Louisiana State Forest is in this region. Pop. 1920, 17,510; 1930, 23,025.

**ALEXANDRIA**, a port and historic city of northern Virginia, on the boundary line of, but not within, Arlington Co. It is situated on the Potomac River, 7 mi. south of Washington, D.C. Steamships, bus lines and six railroads serve the city. There are airports nearby. The region is beautiful farming country, and the city has numerous factories and large railroad shops. In 1929 the manufactures reached an approximate total of \$4,000,000; the retail trade in 1929 amounted to \$8,382,859. It is the seat of a Protestant Episcopal Theological Seminary. Alexandria is a tourist resort, a picturesque place with many interesting landmarks, such as Christ Church, attended by George Washington and Robert E. Lee; Carlyle House, scene of the council of governors; Lloyd House, where Lee received his commission as Commander-in-Chief of the Confederate Army; Gadsby's Tavern, meeting place of Washington and Lafayette; and Washington's headquarters. The Federal Government has a torpedo station here. Alexandria was settled in 1695 and laid out in 1749. Once it did an important shipping business. It was occupied by Federal troops throughout the Civil War. Pop. 1920, 18,060; 1930, 24,149.

**ALEXANDRIAN SCHOOL**, an academy of learning founded in Alexandria, Egypt, by Ptolemy Soter (323-283 B.C.) and Demetrius of Phalerum; and

the name given to certain literary tendencies developed there. The founding of the Alexandrian Library and Museum, together with the munificence of the Ptolemies, attracted to Alexandria many impoverished Greek scholars, and made the city the center of an intellectual movement which lasted for nearly a thousand years. The first period of this movement, from 306 B.C. to the Roman conquest, 30 B.C., is noted for literary and scientific achievements; the second, from 30 B.C. to the Arab invasion, 642 A.D., was in general one of theological activities.

Characterized as a whole, the Alexandrian School stood for learning and cosmopolitanism, for erudition instead of originality and for marked interests in all literary and scientific techniques. In poetry, the favorite forms were the epic, epullion, or "little epic," and didactic and elegiac verse; the outstanding poets were Apollonius Rhodius, Callimachus, Aratus, Nicander, Philetus of Cos, and Sotades. The greatest prose writers were Dionysius Thrax, the grammarian; the critics, Aristarchus, Eratosthenes, Zenodatus and Aristophanes of Byzantium; the historian Polybius; Claudius Ptolemæus, astronomer; the philosopher Philo, and Euclid, the mathematician.

**ALEXANDRINE VERSE**, a French verse form consisting of rhymed iambic hexameter verses with the caesura placed between the sixth and seventh syllables. It was probably named after a 12th century collection of poems written about Alexander of Macedon. Since the 16th century, when it was popularized by the *Pléiade* and especially by PIERRE RONSARD, the Alexandrine has been the meter of French epic verse and classical tragedy. It is also used in comedy, as for example by Rostand in *CYRANO DE BERGERAC*. In English the most noted poem written in the Alexandrine measure is Michael Drayton's *Polyolbion*, representing a 16th century attempt to popularize the form in England. The final line of the Spenserian stanza is an Alexandrine. *See also* FRENCH LITERATURE.

**ALEXANDRISTS**, members of the Alexandrian school of philosophy, a school that flourished between 30 B.C. and 529 A.D. At Alexandria the East and West were brought together. The result was a fusion of Greek philosophy with Oriental religions, producing neither a philosophy nor a theology as such but rather a theosophy. The best Jewish representative of the school is Philo (fl. 40 A.D.), who tried to square Judaism with Greek philosophy and whose main contribution was his conception of the Logos. In its later developments the school became known as NEO-PLATONISM. Best known among this branch are PLOTINUS and his pupil Porphyry (fl. 280 A.D.). Other representatives were Jamblichus, Sopater and Maximus. In the West PLUTARCH (fl. 425) and Proclus (470) were most prominent. The school ended with Damascus when it was suppressed by Justinian in 525. Its influence on Christian thought is best found in Clement (200) and ORIGEN (240).

**ALEXANDRITE**, an emerald-green variety of CHRYSOBERYL, prized as a gem stone, which shows the

property of appearing red by artificial light. It is a beryllium aluminate which occurs in granites, schists and as water-rolled pebbles. Twinned crystals when properly cut show a smooth band of white light, or chatoyancy, whence the name CAT'S-EYE. Alexandrite is found in the emerald mines of the Urals and in Ceylon. It was named for the Russian czar, Alexander II, because discovered the day he attained his majority. It is readily made artificially. *See also* GEM STONES.

**ALEXANDROVSK**. *See* ZAPOROZHYE.

**ALEXIUS I COMNENUS** (1048-1118), Byzantine Emperor during the First Crusade. He was born in Constantinople, in 1048, of the royal family of the Comneni. His bravery and success in the wars against the Turks and in subduing rebellion in Asia Minor and Greece aroused the enthusiasm of his soldiers and they finally forced the ruling emperor to abdicate in his favor. Alexius was crowned in 1081. The empire at this time was seriously endangered by enemies within and without. Alexius drove back the Normans under Robert Guiscard in Thessaly and the Turks in Asia Minor. Through the military successes of the Crusaders, most of Asia Minor was restored to the empire. Although Alexius was an able and industrious ruler his underhand dealings with the Crusaders, with whom he was never on very good terms, fostered a spirit of distrust between West and East.

**ALFALFA**, also called Lucerne, an upright, branching herb (*Medicago sativa*) of the pulse family, cultivated from ancient time as a feed for domestic animals. Its English name is a corruption of the Arabic words *alfacfacah*, meaning "the best feed," and its generic name *Medicago* is Grecian for Mede or Persian feed. It is a native of southwestern Asia whence its spread for many centuries was coextensive with conquest. When the Persians invaded Greece about 480 B.C. they took alfalfa to supply their horses; when the Saracens overran Spain during the 8th century they did likewise and so did the Spaniards when they conquered Mexico and South America. From Mexico it spread to Texas early last century and from Chile it reached California in 1854 and has become the leading forage and hay plant of the irrigated West. More recently its culture has developed in the non-irrigated prairie states where it has also become prominent. In the states east of the Mississippi, although introduced from Europe into New York in 1791, it is restricted to limited areas, and in the South, although successful in many sections it has not become prominent. In the United States as a whole it is steadily gaining as its culture becomes understood and its merits appreciated.

Not only in the irrigated districts of the West, where it is the chief hay and forage crop, but in various other sections of the United States, especially in the north central states, alfalfa is of outstanding agricultural importance. According to the Census of 1930 the northern states lying east of the Rocky Mountains produced 47% of the total yield of alfalfa. In the country as a whole the number of farms report-



ing alfalfa production increased 48.6% from 1919 to 1929; the total acreage increased 33.5% and the yield 24.6% during the same period. In 1929 alfalfa constituted more than one-fourth of the total hay crop of the United States.

The few varieties are practically alike in appearance but are distinguished mainly by their ability to resist alkali, drought, disease and cold. Grimm is hardy in Minnesota; Dry-land popular in Utah, grows well without irrigation; Sand Lucerne, considered a cross between *Medicago sativa* and *M. falcata*, has proved prolific and hardy on the sandy soils of northern Michigan; Arabian, introduced by the U.S. Department of Agriculture, is adapted to the Southwest; and Turkestan, originally imported by Prof. N. E. Hansen for the Department, is more drought resistant than other varieties though no hardier than Grimm. Its stems are more slender and its foliage sweeter than the others. In America it produces but little and usually poor seed, so supplies must be imported.

As stock food alfalfa is valuable because of its palatability and its high percentage of protein. In this respect it is superior to clover and is often substituted for bran as part of the ration for dairy cattle. It is so nearly a balanced feed that it may be supplemented by carbohydrate feeds, such as corn. Pasture cattle eat it so eagerly that they often suffer from bloat, especially if it is dewy and they are hungry when turned on it. This danger may be avoided by feeding them dry fodder before allowing them to graze.

Though as good as other legumes as a soil renewer, alfalfa is little used for this purpose because, when properly managed, it may produce profitable crops for a half century. Its hay is often ground and sold as alfalfa meal. This is used as a substitute for bran to feed domestic animals and poultry.

Alfalfa requires a deep, well-drained, neutral or slightly alkaline soil and a deep permeable subsoil to accommodate the roots which sometimes reach 20 to 30 ft. though usually from 6 to 12. Both acidity and excessive alkalinity are fatal to alfalfa. In the East acidity is neutralized by liming; in the West, alkalinity is reduced by flooding and draining. Well decayed manure is the best fertilizer prior to sowing. Unless alfalfa has previously occupied the land the seed or the soil should be inoculated with alfalfa bacteria. These may be obtained through state experiment stations or the U.S. Department of Agriculture or from an old field where the crop is growing well. Cloudy weather is essential to successful inoculation as strong sunlight kills the bacteria. Deep plowing and several harrowings are needed to make a good seed-bed. Ten to twenty pounds of seed broadcasted to the acre are usual in the West, twice as much in the East.

Failures are caused most frequently by omitting inoculation, winter-killing during the first winter, inferior soil preparation and the choking of the seedlings by weeds during the first summer. In the South the most injurious weeds are crab and Johnson grass; in

the Middle West, crab and foxtail grass; in the East, June or blue grass. These may be controlled by thorough preparation of the soil and disc harrowing with the discs set straight.

Dodder, a parasitic vine which often kills alfalfa, may be destroyed by promptly cutting and burning affected areas. Leaf spot and anthracnose, two fungous parasites, are controlled by mowing and fertilizing with nitrates. For root rot plowing and avoiding alfalfa on the field for several years is the only remedy. Prompt mowing controls the worst insect enemies by lessening their food. M. G. K.

#### ALFALFA PRODUCTION, U.S.

4-Year Average, 1927-30

Division	Production (Tons)	% of Total
UNITED STATES	29,848,000	100.0
LEADING STATES:		
California	4,314,000	14.5
Nebraska	2,916,000	9.8
Idaho	2,154,000	7.2
Kansas	2,084,000	7.0
Colorado	1,934,000	6.5
Montana	1,515,000	5.1
Minnesota	1,475,000	4.9
South Dakota	1,330,000	4.4
Utah	1,328,000	4.4
Michigan	1,154,000	3.9
Iowa	1,063,000	3.6

**ALFALFA WEEVIL** (*Phytonomus posticus*), a European beetle, found in Utah and neighboring states early in the 20th century. The adult weevil is dark brown in color, and less than ¼ in. long. It spends the winter in crevices in the ground, emerging in the spring to lay its eggs in the stems of alfalfa



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ALFALFA WEEVIL

plants. The greenish larvae hatch in from one to two weeks, and feed on the leaves. When full-grown the larvae spin cocoons in curled leaves, on the stem or on the ground, and after about ten days, emerge as adult beetles. See also BEETLE.

**ALFARO, ELOY** (1842-1912), Ecuadorian general and statesman, member of the liberal party and strong opponent of Pres. Garcia Moreno. After an unsuc-



cessful revolt in 1865, he was forced to live in Panama until the death of Garcia Moreno in 1875. On his return he proposed a convention to abolish the system established by his opponent, and, when this was rejected, joined General Veintemilla in a revolt against the government. From this time to 1895 he engaged in a number of unsuccessful revolutionary movements. He succeeded in overthrowing Pres. Cordero in 1895, called a constitutional convention, and in 1897 was elected president. At the end of his Presidency he passed the office on to General Plaza Gutierrez, who in turn was succeeded by Lisado Garcia. This succession angered Alfaro and he again revolted and overthrew the government, becoming president a second time in 1907. Not content with political conditions at the expiration of his second term, he revolted in 1911, but was captured and imprisoned. In Jan. 1912 he was dragged from his cell by the enraged populace and murdered. It was during his political ascendancy that the clerical program of the Conservative Party was reversed, and the Liberal régime inaugurated which still exists in Ecuador.

**ALFIERI, VITTORIO** (1749-1803), Italian poet and dramatist, was born at Asti, in Piedmont, Jan. 17, 1749, of rich and noble parents. He was sent to the Academy of Turin, where, he says, he learned little, but acquired a taste for literature. After several years spent in travel and in living the usual life of a young nobleman of the period, he gave his estates to his sister and, retaining an income sufficient for himself, settled down in Tuscany to study Italian literature. His first dramatic effort was a dialogue written to amuse a lady with whom he was in love. Fired by its success when produced as the play, *Cleopatra*, at the theater in Turin in 1775, he began to write seriously. He published in all, 21 tragedies, six comedies, many sonnets and odes, six of the latter on the subject of American independence. Alfieri's tragedies, for which he is chiefly remembered, were written with an unvarying adherence to the Greek unities of time, place and action, but with subjects chosen from many races and periods. Among them are *Œdipus*, *Myrrha*, *Clytemnestra*, *Orestes*, *Philip II*, *Mary Stuart*, *Abel and Saul*. He married the Countess of Albany, widow of Charles Edward, the Pretender, and spent his last years in Florence where his house was a mecca for the fashionable and intellectual. He died at Florence, Oct. 8, 1803.

**ALFRED or AELFRED THE GREAT** (848-c. 899), king of Wessex, was born at Wantage, Berkshire, the youngest son of King Aethelwulf. Little of his life is known until he came to the throne in 871, following the brief reigns of his brothers, Aethelbald, Aethelbert and Aethelred. He won nine battles with the Danes in 871. Seven years later the Danish king, after Alfred's capture of his stronghold, promised to leave the kingdom. Peace was maintained until 892 when the restless Danes returned to attack. Alfred had learned a lesson from the military failures of his father and brother, and in the years of peace had built defenses and increased his army. The war lasted

until the invaders scattered to Northumbria, East Anglia and back to the Continent. Thereafter Alfred reigned over Wessex without challenge, and, by firmly holding the Danes in check, saved England for the Anglo-Saxons. The remainder of his life was devoted to strengthening the machinery of his government, and to providing the West Saxons with opportunities for education. Unable to find scholars within his kingdom, Alfred brought them to England from the Continent. They translated many Latin volumes into the West Saxon dialect, Alfred himself translating Latin works which he believed to be of educational value. Among these works are Boethius's *Consolation of Philosophy* and Orosius's *History*.

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**AL FRESCO THEATER.** Records of theatrical history extend back for about 25 centuries. Save for the last 400 years in all that period the theater was a thing of the open air. It only came indoors when civilization moved to the inclement regions of northern Europe and began to create a spectacular and illusionistic art.

The demand for the revival of open-air theaters and productions is comparatively a recent thing, and is a result of a revolt from the artificialities of a stage that had been too long immured within walls. The modern open-air theater has four prototypes. First are the theaters that are either imitated directly or adapted from the classic Greek and Roman models. Among these are the Hearst theater at Berkeley, and theaters at Point Loma, Pomona and Bakersfield, Cal. Although architecturally impressive and suitable for convocation purposes these theaters set rigid limits on modern productions. The medieval passion play stage has certain survivals in modified form, the most famous being the theater of the passion play at Oberammergau in Bavaria which, however, has a roof over the auditorium. The formal garden theaters found on many campuses, in public parks and private estates are inspired by the famous Palazzo Gori near Siena, Italy, or the water theater at Versailles, France. Finally there are nature theaters of a great many varieties, most of which tend to employ natural amphitheatres on hillsides or against a background of trees. Among these perhaps the most famous American theater is the Grove theater of the Bohemian Club in California.

For open-air performance a special kind of production is called for. Elizabethan comedies and pastorals have been found suitable. Within the last 25 years there has been a revival in the composition of pageants and masques especially for open-air production.

T. H. D.

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**ALGÆ**, an immense group of structurally very simple plants, the best known of which are the seaweeds. The Latin word *alga* was applied by the Romans to a common red seaweed, but is now a

group name for thousands of different plants ranging in size from microscopic organisms such as pond scum to the giant kelp of Pacific waters which may be several hundred feet long.

While most algæ live in the sea or in fresh water others are perfectly at home on the bark of trees or on moist earth, and some of them form the greenish slime on wet floors of dairies and greenhouses. They grow all over the world from the Arctic, where one of them reddens the snow, to the warmest waters of the tropics, where they often assume the aspect of corals and are sometimes mistaken for them.

The structural simplicity of the algæ is based upon the fact that they belong to the *Thallophyta*, or plants without roots, stems or leaves. But even the simplest of them contain chlorophyll and thus manufacture starches and sugars. A few of them live symbiotically with a fungus, the resulting organism being a LICHEN.

There are four main groups: (1) The blue-green algæ, mostly fresh-water, microscopic, usually slimy and sometimes causing an unpleasant taste to drinking water. (2) The green algæ, mostly fresh-water or on bark, microscopic and often filamentous, the most familiar being pond scum. (3) The brown algæ, mostly marine between high and low tide. These are our common brown seaweeds, much branched, and often supported by buoyant bladders. One of them, the Gulf-weed, causes the SARGASSO SEA. (4) The red algæ, mostly in deep, tropical seawater, beautifully colored and branched. They form tropical sea-gardens, and some of them help corals to make atolls.

Few algæ are of economic importance, but dulse and bush moss furnish food, agar is used in medicine, and much agricultural potash is harvested from kelp. See also THALLOPHYTES. N. T.

**ALGARDI, ALESSANDRO** (1602-54), celebrated Italian sculptor, was born at Bologna, Italy, in 1602. His chief works are a colossal marble relief of Attila and Leo I. in St. Peter's at Rome and a monument of Leo XI. Algardi is ranked next to GIOVANNI BERNINI among Italian sculptors of the 17th century. He died at Rome, June 10, 1654.

**ALGEBRA**, that part of MATHEMATICS in which is taught the general representation of numbers by means of letters, and particularly the use of such symbols and others in solving EQUATIONS. This method is employed in all branches of analysis, but the general use of such symbols is taught in elementary algebra. In higher algebra the elementary symbolism thus learned is applied to subjects like series, higher equations, determinants, and the rudiments of the theory of numbers.

As an example of the advantage in using letters to represent numbers, the pupil learns in the intuitive geometry of his course in arithmetic that the number of units of area of a triangle is equal to half the number of units of length in the base multiplied by the number in the height. Algebra states all this in algebraic shorthand by simply writing  $A = \frac{1}{2}bh$ , which means  $\text{Area} = \frac{1}{2} \text{base} \times \text{height}$ . Similarly, instead of writing, "The circumference of a circle is

equal to twice the number 3.14159 . . . times the number of units of length in the radius," we write simply  $C = 2\pi r$ . If we wish to indicate that the square of the sum of two numbers is equal to the sum of their squares plus twice their product, we simply write  $(a + b)^2 = a^2 + b^2 + 2ab$ , this being true whatever the values of  $a$  and  $b$ . In the solving of problems, we may represent the numbers by letters and solve so as to find the value of one of them, usually represented by  $x$ , the unknown quantity. The result is a formula which holds good for all problems of that particular kind; so that if we have another problem of that kind we need not solve it all through. We need only use the same formula once obtained. Further details may be found in any textbook on elementary algebra.

The word algebra comes from the Arabic *al-jabr*, meaning the reunion of broken parts, whence in some parts of the world an *algebrista* was formerly one who could reset broken bones. In mathematics the word came to mean the taking of a term from one side of an equation and reuniting it, with the sign changed, to the other side. It therefore came to be used to designate that part of mathematics which dealt with equations. When special symbols came to be extensively used to represent numbers and operations, for example,  $x$ ,  $a$ ,  $-n$ ,  $x^n$ ,  $+$ , and  $a^2$ , and their predecessors, the term was still applied to that branch of mathematics in which equations were studied, even where they were not particularly in evidence. Thus the study of such operations as  $(a + b)(a - b)$  was looked upon as a part of algebra in certain countries, although as a part of arithmetic in others.

**Symbols.** In general it may be said that the symbols now in use date from the century 1550 to 1650, of course with certain exceptions. Therefore algebra as we know it to-day is only a little more than 300 years old, although equations were studied more than 3,000 years ago. An expression like  $(x + a)(x^2 - b^4) = k$  would have been meaningless to Rudolff, Cardan, Tartaglia and Recorde, who wrote the first noteworthy algebras in the 16th century.

The 15th century symbols for plus and minus were usually  $p$  and  $m$ , although Johan Widman used  $+$  and  $-$  in his arithmetic of 1489, but merely to indicate excess and deficiency, and not the operations of addition and subtraction. They seem to have been first used to represent operations in 1514, by a Dutch mathematician, Vander Hoecke. The symbol  $\times$  for multiplication began to be used in England about 1600. The  $\div$  for division did not appear until the Swiss algebraist Rahn gave it in his algebra in 1659, the book being translated into English in 1688. It was thereafter used in the English-speaking countries, but has never been generally recognized elsewhere.

The most common of early radical signs was  $\mathcal{R}$ , a contraction of the Latin *radix*, meaning root, whence also *radish* and *radical*. The symbol occurs frequently in the 15th century, but also for various other purposes, including *res* (Latin for thing, the unknown quantity), *ratio* and *recipe* (Latin for take, as in

physicians' prescriptions at the present time). Our present symbol  $\sqrt{\quad}$  first appeared in Rudolff's algebra, *Die Coss*, that is, the *cosa*, thing, because the unknown quantity was so called by the earlier Italian writers. The fractional exponent, as in  $x^{\frac{1}{2}}$  for  $\sqrt{x}$  did not become commonly used until the English mathematician Wallis (1655) generalized exponents by explaining such forms as  $x^{-n}$ ,  $x^{\frac{1}{n}}$  and  $x^{\frac{p}{q}}$ , and Newton (1669) made extensive use of them.

The symbol  $=$  was first used in print to indicate equality by the English writer Recorde (1557), although it had been used in manuscript form somewhat earlier as an equivalent of the older form  $\propto$ . The symbol  $::$  for equality of ratios (a proportion) was introduced by the English writer Oughtred (c. 1628), and the symbols  $>$  and  $<$  were due to Harriot (1631). Our exponents, as in  $a^4$ , first appeared in this distinct form in the great mathematical work, *La Géométrie* of DESCARTES (1637) and were extended later by Wallis as already stated. Before this period there were forms like  $Aq$  (*A quadratus*) or  $aa$  for  $a^2$ .

The above statements suffice to show the general transition from the cumbersome forms of the 16th century to the simpler ones of the century following, most of which, standardized in textbooks, have continued to the present time. Some idea of the great improvement made in this phase of the subject since the beginning of printing may be seen in the following equation given in Pacioli's Italian work of 1494: "Trouame. 1. n°. che giôto al suo qdrat° facia. 12," translated, Find me a number which added to its square makes 12. In our algebraic languages, "Solve  $x + x^2 = 12$ ."

**Language.** The name for the "unknown quantity" has had many vicissitudes. The ancient Egyptians used a word meaning "mass" or "quantity." Diophantus (c. 275) used in Greek the expression "an undefined number of units." The Arabs used a word meaning "anything" or "thing," and their Latin translators (12th-13th centuries) used *res* (Latin for thing), whence the Italians used *cosa* (thing, from the Latin *causa*, French *chôse*) and so the Germans (16th century) called algebra the *Coss* and the English called it the *cossike arte*. Such terms as coefficient, monomial, polynomial, radical, exponent and aggregation are, like addition, subtrahend and quotient, from the Latin writers, being imposed upon the schools through the early printed books.

**Equations.** The early Egyptians, Sumerians and Babylonians knew how to solve certain quadratic equations more than 3,000 years ago. The Greeks understood their equivalent geometric forms. The Hindus could solve them early in the Christian era, and thereafter they became generally known, the solutions being made by rule. The cubic equation was solved for special forms by the Greeks, probably by Archimedes (c. 225 B.C.), Arabs (9th century), Persians (Omar Khayyam, the poet, c. 1100), and medieval Latin scholars. In the 16th century it was solved for the general case, that is, in our symbols, for

$x^3 + ax^2 + bx + c = 0$ , by Tartaglia and Cardan, and the biquadratic equation was solved by Cardan's pupil Ferrari. Not until Galois's memoir appeared (posthumously published in 1846) was there a satisfactory proof given that literal equations above the fourth degree could not, in general, be solved by the machinery of elementary algebra. The roots of numerical higher equations can, however, be approximated by various methods, one of the best known being that of Horner (1819).

**Topics of Algebra.** From this historical survey it is evident that the range of topics considered must necessarily have varied greatly. Algebra was not a practical subject until within the last 300 years, and much of it is not practical enough to-day to make that part worth teaching to children. It was born as a puzzle, interesting to a certain class but not to people in general. It was never looked upon as a subject for elementary schools until the 19th century, and it attained this status only by the claim of mental discipline, which was at that time unduly exaggerated.

The fundamental operations of arithmetic have varied in number from one to nine, or even more in some textbooks. They were taken over by algebra when it asserted its position as generalized arithmetic, but the number was generally assumed to be four: addition, subtraction, multiplication and division. Negative numbers and surds, being too difficult for arithmetic, were made a part of algebra and had a place in these operations. Out of all these operations, however, none has, as commonly taught, any reason for being. In practical mathematics the division of one polynomial by another never enters, at least until the learner is mature enough to do the work without preliminary teaching. It is the same with powers and roots; they serve to explain the arithmetical process of finding roots, but in actual life situations practically no one finds roots except by tables, by logarithms, or, less often, by calculating machines.

Algebraic fractions found a place in the same way. They are rarely used in the forms given in textbooks. The work of reducing them to the lowest terms is of no practical value, since most of the fractions of the book type are artificially made to allow for this reduction and are never required in science or business.

The equations given in algebra courses are of value chiefly in learning algebraic manipulations. Those used in science are rarely of this type. The student who takes up the calculus needs to know only a small part of the algebra textbook offering. The solution of a linear or a quadratic equation in one unknown represents about all that the average citizen will be called upon to know of this topic. The solution of simultaneous linear equations of more than two unknowns, or of simultaneous quadratics of any type is of little value, this value being found chiefly in analytic geometry. In most cases a graph serves all theoretical purposes, such as the recognition of the number of possible roots, and even this recognition is a matter of little practical value in physics and other applied branches. The subject of series has a

commercial value, but is chiefly for technicians and for showing the value of compound interest.

**Value of Algebra.** What then is the valuable part of algebra for most people? Not factoring as taught in the schools. That is of value only in solving a numerical higher equation which is made up to use factoring, or in reducing a fraction to lowest terms which is also made up for the same purpose. Similarly, the valuable part is not found in the other operations with polynomials. It is not found in the problems, most of which are puzzles, puerile in content. The valuable part of algebra lies in the framing and manipulating of formulas, without which no one can make any real progress in the sciences or can understand the simple algebraic forms used in commerce, in finance, or in the popular books and periodicals on mechanics.

In connection with formulas there are four important matters to be considered: (1) How is the formula discovered? (2) How is it evaluated when the values of certain letters are known? (3) How is it pictured by a graph, and for what practical purpose? (4) If stated as an equation, how can this equation be solved for any one letter in terms of the others? In these four points there enter the practical manipulation of algebraic expressions, limited to monomials and binomials; the evaluation of fractions and integral expressions, generally limited to binomials; a need for integral, fractional, and sometimes negative exponents; and a need for graphs, generally limited to expressions not above the third degree in any variable.

As schools come to recognize more clearly, as they do in Europe, the close relation of mathematics to the sciences, the work in elementary algebra will tend to concentrate on these values. The most reactionary influences retarding this movement at the present time are the extra-mural tests and examinations, which feel bound to set traditional questions as found in textbooks, which books include this kind of work because it is given in the examinations,—an unfortunate example of a vicious circle.

**Tools Needed.** Since the formulas of algebra are stated in algebraic language, the pupil must be familiar with this language as far as it is actually used. The following are among the important topics:

1. Meaning of negative numbers. It is not necessary that all kinds of directed numbers be considered in elementary work, for this would lead into the study of COMPLEX NUMBERS and QUATERNIONS.

2. Operations with negative numbers, as in the case of  $(-2) \times (-5)$ .

3. Knowledge of the meaning of letters as representing numbers of all kinds: integral, fractional, negative, and others as they may arise, and the ability to use these in formulas.

4. Knowledge of the meaning of exponents, limited chiefly to those which enter into common formulas. The interchange of fractional and the earlier radical symbols for roots, and the relative advantages of the two in different cases. While it is interesting to know that  $a^0 = 1$ , the pupil will never need it in practical

work, for if he divides  $a^n$  by  $a^n$  he will see that the quotient is 1 without taking the useless way of writing  $a^{n-n} = a^0 = 1$ .

5. Knowledge of the meaning of a coefficient and of the common way of indicating products by the absence of a sign or occasionally by a dot. The pupil in pure algebra need never use  $\times$  for multiplication or  $\div$  for division.

These tools are actually needed, except where the contrary is stated, and familiarity with their use is not difficult to attain. All such work as  $-[b - c(a - b)]a - b$  or  $a^0b^{-1}c^{\frac{1}{2}}d^{-\frac{1}{3}}$ , still found in certain examinations and standardized tests, is useless except as algebraic puzzles. The sooner our courses are purged of such work the better it will be for algebra.

The above limitation refers to the general student. For one whose interest is in mathematics as a science there need be set no limits whatever. The best use of his time, however, will lead to considering the fundamental operations only as clarifying the work with numbers, e.g., in explaining scales of notation and checks on computations; to considering the theory of series and of equations; and eventually to entering the domain of higher algebra. He will also find pleasure in preparing for the work in differential equations, in grasping the ideas of other number systems, in seeing the generality of complex numbers, and in paving the way for such branches of study as determinants, theory of functions of a real or a complex variable, the theory of numbers, the theory of groups, infinite series, and other departments of analysis. For popular statements of the significance of these branches the reader may consult the respective topics in this encyclopedia.

D. E. S.

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**ALGECIRAS**, a seaport of Spain on the gulf of the same name in the province of Cadiz. Located near Gibraltar and having a fortified harbor, it was the first foothold gained by the Moors in their conquest of Spain and was held by them from 711 until 1344. The Algeciras Conference was held here in 1906; its purpose was to establish the rights of France and Germany in Morocco. Algeciras has good trade in coal, leather and grain, and fishing is an important industry. Est. pop. 1929, 19,000.

**ALGECIRAS CONFERENCE, THE.** In the imperialist scramble for North Africa, France secured the consent of the Italians and of the British for her proposed protectorate over Morocco, but she ignored the attitude of the Germans. In 1905 Kaiser Wilhelm II, whose ire was aroused by such procedure, brought on an international crisis by appearing at Tangier and emphasizing in a glowing speech the independence of the Sultan of Morocco. To settle the crisis and to determine the status of Morocco, a general conference of European powers was held at Algeciras in 1906. It decided that the independence of the territory be

adhered to, that the open door policy be followed in respect of trade, but that France and Spain be allowed to organize and instruct the native police force.

**ALGER, HORATIO** (1832-99), American author of boys' books, was born at Revere, Mass., Jan. 13, 1832. In 1864-66 he was pastor of the Unitarian Church in Brewster, Mass. He later came to New York and did social work, trying to improve the conditions of street boys. His experiences with poor boys led him to write of them in such series as the *Ragged Dick*, *Tattered Tom* and the *Pluck and Luck* group, in which he tries to show that the rise of his heroes from poverty to success is due to religion, thrift and honest work. Alger died at Natick, Mass., July 18, 1899.

**ALGER, RUSSELL ALEXANDER** (1836-1907), American soldier and capitalist, was born in Medina Co., Ohio, on Feb. 27, 1836. He taught school for two years, and was admitted to the bar in 1859. He began to practice at Cleveland, but moved to Grand Rapids, Mich., in 1860, where he started a small lumber business. At the outbreak of the Civil War he enlisted in the 2nd Michigan Cavalry and rose to the rank of colonel under Gen. Sheridan. As the war ended he was brevetted major-general of volunteers. Resuming his lumber business in Detroit, he soon amassed a considerable fortune. He was Republican governor of Michigan in 1885-87. In 1889 he was named commander by the national encampment of the Grand Army of the Republic. Alger had been prominently mentioned for the presidency when President McKinley named him as Secretary of War in 1897. The difficulties of the War Department during the Spanish-American War were charged against Secretary Alger and he became very unpopular. For a time President McKinley supported him, but finally requested his resignation in July, 1899. Alger was appointed to a Michigan Senatorial vacancy in 1902, and was elected the following year for the term ending in 1907. He died at Washington, D.C., on Jan. 24, 1907.

**ALGERIA**, a French colony on the north coast of Africa, extending from the Mediterranean to the Sahara, and situated between Morocco on the west and Tunis on the east. The northern part of Algeria extends inland for about 350 mi.; beyond this the southern or Saharan territories extend indefinitely into the desert to join French West Africa. In all Algeria has an ill-defined area estimated at about 847,500 sq. mi.

The census of 1931 gave the population of the northern territory as 5,978,833; and the southern territories as 574,618. Of the population 920,788 are Europeans, chiefly settled in the more northerly districts. More than three-quarters of the natives are Berbers. Under certain conditions natives may become French citizens. By decree all the Jews are French citizens. From Algeria come the Kabyles, or Zouaves, some of the bravest soldiers in the French army. The chief language of Algeria is Arabic. The principal towns are ALGIERS, ORAN, PHILIPPEVILLE and Bone on the

coast; CONSTANTINE, the chief interior city, and Biskra, an oasis town. There are three main administrative divisions: Algiers Department, Oran Department and Constantine Department. These rank as departments of France, each sending one senator and, since 1928, three deputies to the French chambers. The four southern territories are under four military commanders.

**Surface Features.** Inland from the coast Algeria has three distinct regions: the Tell, the high plateau and the Algerian Sahara. The comparatively small area of lowland is mainly coastal, but the Tell is diversified by broken ranges of the Maritime Atlas largely composed of crystalline and volcanic rocks. Draining to the coast are a number of streams. In the valley of the river Chelif are two important irrigation systems. The Tell is the region in which most of the agriculture is carried on. The high plateau is bordered on the south by the Saharan Atlas, where Sheliah, the highest peak in Algeria, rises to 7,585 ft. The plateau provides fodder for cattle after the winter rains. The Algerian Sahara consists mainly of sandy dunes with numerous oases.

**Resources.** There are extensive cork forests, a small area of cedar, and large quantities of Aleppo pine and evergreen oak. Large crops of wheat, barley, oats, tobacco, olives and vines are cultivated. There is an enormous production of wine; 282,315,550 gallons were made in 1929. Fruits are extensively grown. Mineral output includes iron ore, phosphate of lime, zinc, and small quantities of coal and oil.

Manufactures are not important, but tobacco factories and flour mills exist in the principal coast towns. Native crafts include carpet weaving, pottery and leather work. Fishing is carried on at the ports, catches chiefly consisting of sardines, anchovies, mackerel and oysters, etc. X.

#### HISTORY

The Phoenicians as early as the 12th century B.C. founded colonies on the northern coast of Africa, but almost nothing of their history has survived. Carthage, child of Phoenicia, was her heir in the western Mediterranean, where she exercised sway for seven centuries. Following the destruction of Carthage in 146 B.C., the Romans gradually occupied northern Africa, organizing in the region of modern Algeria the provinces of Mauritania Caesariensis to the west, and Africa to the east. Many Roman colonists migrated to North Africa and a flourishing civilization, based on prosperity derived from agriculture, developed. But much of present-day Algeria was never occupied by the Romans.

**Arab Conquest.** The Vandal invasion from Spain in 429 was a rude shock to Roman Africa, but Christian Roman civilization was not forthwith submerged. In 534 came the successful expedition of Belisarius which restored this region to the Byzantine Empire, a connection which was to last, nominally, at least, until the first Arab conquest of the 7th century. In the period of disorder and strife that ensued, Chris-

tianity was completely replaced by Islam. A second Arab invasion occurred in the 11th century. The invaders, being a small minority, did not radically change the ethnological character of the population, but their cultural contributions were of profound and enduring nature. At times during the 11th, 12th and 13th centuries Algeria formed a part of the powerful empires of the Almoravids and ALMOHADS, which centered in Morocco and included Spain. This was a period of notable progress in Saracenic civilization. With the breaking up of the Almohad empire in the 13th century the independent Kingdom of Tlemcen arose in the region of modern Algeria under the Abd-el-Quadites. Although this dynasty continued to reign down into the 16th century, it never succeeded in enforcing its authority in all the territories that it claimed, nor in establishing order. In the 16th century it fell an easy prey to invaders.

The Spanish, having by the close of the 15th century recovered their peninsula from the Moors, continued the "Holy Crusade" against the infidel in North Africa, conquering all the important ports as far as Tripoli. No serious attempt, however, was made to occupy the hinterland. Very soon Spain encountered here the rivalry of the Ottoman Turks who were welcomed in by the Muslim natives. The two brothers Barbarossa, Greco-Turkish corsairs, appeared in Algeria early in the 16th century, destroyed the ruling line of the Kingdom of Tlemcen and paid homage to the Sultan at Constantinople. Thus was created the Regency which was to continue for three centuries. During this period Spain lost all her holding in Algeria, abandoning Oran finally in 1791. The history of the Regency is marked by a gradual increase in independence from the Porte and the prevalence of chronic anarchy. During these three centuries Algeria was the leading pirate center of the Mediterranean. Punitive expeditions sent occasionally by the various commercial powers accomplished only temporary results, and this nuisance, together with the payment of tribute, was not terminated until the second decade of the 19th century.

**French Conquest.** The modern history of Algeria really begins with the occupation of the country by France in 1830. This came about as a result of an insult inflicted upon a French consul by the Dey. France had little difficulty in dispossessing the Turkish regents, but a great deal in establishing effective control over the native tribes. For several years evacuation was seriously considered. Not until the suppression of the revolt of Abd-El-Kader, 1839-47, may France be said to have gained a firm foothold in Algeria. Questions arising out of this revolt embroiled France in war with Morocco in 1844. By the Convention of Lalla Mar'nia, 1845, between Morocco and France a boundary arrangement was made which was later to prove very unsatisfactory and a constant source of difficulties. General Bugeaud, a man of great energy and ability, in command in Algeria during 1841-47, performed great service for France by creating the African army adapted to local warfare

and by setting up a department of native affairs and Arab bureaus. He considered French colonization highly desirable and did all he could to encourage it. At a later date Napoleon III opposed the policy of colonization, preferring one of economic development by great financial companies. In this period the tribes were conceded ownership of the lands which they occupied, were declared French subjects and given facilities for acquiring citizenship. During the period of the vexatious uprising of the Oulad Sidi Sheikh, 1861-83, fresh troubles arose between France and Morocco. Border disturbances in 1881 afforded the French a pretext for establishing a protectorate over Tunisia.

The Third French Republic at first followed a policy of complete assimilation of Algeria to France. Colonization was revived and it was made easier for Europeans to acquire lands from the natives. The Governor-General's position was reduced to that of a mere instrument of the central government at Paris. The disadvantages of dealing with Algerians as Frenchmen and of settling Algerian problems principally at Paris became apparent before long, and following an investigation made by a senate committee under Jules Ferry a marked change in policy was made. In 1896 the Governor-General was restored to his former position as real head of Algerian administration. Two years later was created the existing system of government, providing for a Supreme Council of officials and elected members, and an assembly of three sections in which are represented the natives as well as Europeans. Considerable power over financial matters was given these bodies in 1900. Meanwhile the French had pushed far southward into the Sahara, and in 1902 Southern Algeria was organized separately from the north.

In recent years the tendency has been to eliminate all differences existing between the status of natives and Europeans in matters of taxation, courts, and administration. Recent French policy toward the natives had been on the whole progressive and wise, and the results appear to have been largely beneficial. During the century of French control the population of Algeria has increased three-fold and astonishing material progress has been made. The World War gave Algeria an opportunity to prove her loyalty to France. She did so by furnishing 173,000 soldiers and 119,000 workers. Moreover the natives remained tranquil despite attempts to incite them to revolt.

Besides being the principal pivot for the creation of the great French Empire of northwest Africa, Algeria has been the training school of the second French colonial empire.

E. F. C.

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**ALGIERS**, the chief city and capital of Algeria and the largest city in northwest Africa, on the west



shore of the Bay of Algiers, in the Mediterranean Sea. It has a poor natural harbor, like most of the coast towns of Algeria, but was for long the headquarters of the Barbary corsairs. It now has modern protection and harbor facilities for shipping, and has become the great commercial center of Algeria, dealing with nearly half the total trade, though in recent years its commerce has declined relatively to that of Oran. The chief exports are wine, fruit, olive oil and cork. The present city, encircled by hills and strongly fortified, is divided into two parts: the old or high town, and the new or low town. Algiers receives a large number of tourists yearly, and has schools, a university, a cathedral, churches, a museum and a library. Pop. 1926, 226,218, mostly Europeans.

**ALGOL** (*Beta Persei*), a star of the second magnitude and the second brightest star of the constellation PERSEUS. Its name is derived from the Arabic *Al Ghoul* meaning the demon. An ECLIPSING BINARY, normally it appears of the second magnitude, but at regular intervals of 2 days, 20 hours, 49 minutes, its brightness decreases to the fourth magnitude. Of its two component stars one is 2.6 times larger in diameter than the sun, and 102 times more brilliant; the other 3 times larger and 8 times brighter. The distance between these two stars is some 11 million miles, and the distance of the system from the earth is 116 light years. See STAR: *map*.

**ALGONKIAN**, an Indian linguistic stock, formerly occupying a larger area than any other North American stock. The boundaries of Algonkian territory roughly approximated the 55th parallel from the coast of Labrador west to the Rocky Mountains, extended from the Churchill River roughly southwest to the Ohio River and Cape Hatteras and skirted the Atlantic seaboard from the Neuse River north to Newfoundland. These boundaries are essentially those of the northern woodland, a determining factor in Algonkian culture. According to tradition and linguistic evidence their original home was on the Atlantic coast between the St. John River in New Brunswick and the Delaware whence they migrated west and south. They appear to have preceded the mound builders and the Iroquois in New York and Ohio. At an early date the Arapaho, Gros Ventre and the Blackfoot migrated westward and became representative nomadic hunters of the bison. The Cheyenne, as evidenced by a less definite linguistic specialization, migrated to the plains at a somewhat later period. Specific culture traits varied widely as would be expected in so large an area. In general, the Algonkian tribes were semi-sedentary hunters and trappers of game and agriculturists; an exception to be noted is in those of the plains and cold regions of Canada, where hunting was the chief means of livelihood. Maize was the staple food product. Clothing was made chiefly from animal skins tanned until soft and pliable and sometimes ornamented with paint, porcupine quills, beads made from shells and, after the advent of the whites, china and glass beads. The

typical Algonkian lodge was the WIGWAM, an arbor-like or conical structure covered with sheets of bark. Canoes were of both the birch bark and dugout types. The stock included several hundred tribes and sub-tribes, speaking approximately 40 distinct languages and a large number of dialects. The principal linguistic divisions of the Algonkian tribes are as follows:

- A. Blackfoot. 1. Piegan. 2. Blood. 3. North Blackfoot.
- B. Cheyenne. 1. Northern and Southern Cheyenne. 2. Probably the Sutaio (extinct).
- C. Arapaho. 1. Northern and Southern Arapaho. 2. Gros Ventre (Atsina).
- D. Eastern-Central Division:
  - a. Cree-Montagnais Type. 1. Cree. 2. Montagnais. 3. Naskapi. 4. Menomini. 5. Sauk and Fox. 6. Kickapoo. 7. Shawnee. 8. Abnaki-Micmac Type (Abnaki, Pennacook, Micmac, Malecite, Passamaquoddy, and Penobscot).
  - b. Ojibway Type. 1. Ojibway. 2. Potawatomi. 3. Ottawa. 4. Algonkin. 5. Peoria. 6. Natick. 7. Delaware. 8. Illinois. 9. Miami.
  - c. Massachusetts Type. 1. Massachuset. 2. Narraganset. 3. Wampanoag. 4. Nauset. 5. Montauk. 6. Nipmuk (possibly). 7. Connecticut River Indians (possibly).
  - d. Uncertain Type. 1. Unami. 2. Unalachtigo. 3. Munsee. 4. Wappinger. 5. Mahican. 6. Pequot.
  - e. Unclassified. 1. Nanticoke. 2. Conoy. 3. Powhatan. 4. Weapemeoc. 5. Secotan. 6. Pamunkey. 7. Piankashaw. 8. Mattaponi. 9. Chickahominy.

**ALGONKIAN ERA.** See PROTEROZOIC ERA.

**ALGONQUIN PARK**, a Provincial Park in the Ontario highlands, 200 mi. northeast of Toronto and 170 mi. west of Ottawa in the province of Ontario, Canada. The park comprises 2,721 sq. mi. at an elevation of from 1,200 to 1,500 ft. above sea level with lakes, rivers and extensive virgin forests. Excellent opportunities for fishing, canoeing and camping are the chief attractions of this national recreation ground. Game is unconditionally protected and the use of firearms is prohibited. Lakes and rivers abound in speckled trout, small mouth bass, and salmon trout. Rainbow trout and muskies are found in some sections. Improved motor highways and two lines of the Canadian National railway traverse the park.

**ALGORISM**, a word derived from the name of the Arabic scholar al-Khowârizmî (c. 825), and originally used to designate the kind of arithmetic in which our common (incorrectly called "arabic") numerals were used as set forth in al-Khowârizmî's books. It has of late been used to mean any type of operation in which these numerals are used, and hence the corresponding algebraic operations.

**ALHAMBRA**, the fortress and palace of the Moorish kings of Granada, Spain, situated on an eminence surrounded by parks and gardens, north of the city of GRANADA. It is considered the finest monument of Arabian art in Europe; its first buildings were erected by Mohammed I and II in 1232-72, the main part of the fortress in 1273, and the beautiful interior ornamentations were not completed until the 14th century. Much of the Alhambra was torn down by Charles V, who began to build in its place a pal-



ace which was never finished. High, massive walls, strengthened by towers, surround the buildings.

The palace encloses two open courts decorated with fountains and halls. West of the Plaza de los Algibes is the Alcazaba, the former fortress, with two towers, and on the east, the palace of Charles V. On the north is the palace proper. The columned Myrtle Court is entered first, and beyond it the vestibule leading to the great square Court of the Ambassadors, with window niches on three sides and a stalactite-like dome. On the east are the Lions' Court, which takes its name from the 12 lions whose backs support the black marble fountain, the Hall of Judgment, the Hall of the Two Sisters, the hall named after the famous Arabian family of Abencerrajes, the porch of the mosque and a row of baths. The rooms mentioned are the most beautiful and splendid of the palace, with walls and domes lavishly decorated; colored plaster and tiles being the principal materials of ornamentation. After Ferdinand and Isabella conquered Granada in 1492, the former granted 50,000 pesetas annually for the upkeep of the palace. Later it became a fortress and penitentiary, but was restored by the Spanish government in 1845. In 1890 it was injured by fire. Among the books on the subject, the most popular is *Tales of the Alhambra* by Washington Irving, who wrote in one of the rooms of the palace.

**ALHAMBRA**, a city in Los Angeles Co., southern California, situated 6 mi. northeast of Los Angeles, and served by the Southern Pacific Railroad, the Pacific Electric Railway and an airport. Citrus fruits, nuts and vegetables are grown in this region. Alhambra is essentially a residential community, but there are factories turning out beekeepers' and oilwell supplies, steel wheels and tanks, pumps, gas regulators and felt products. Beekeeping is a special occupation. The retail trade in 1929 amounted to \$14,600,861. Oil and hot mineral springs are found in the vicinity. Alhambra occupies a tract of land set aside from the ranch of Benjamin D. Wilson who named the city. It was incorporated in 1903. The Spanish-Moorish style of architecture predominates. Adjoining the city is San Gabriel Mission built by the Franciscans in 1771. Pop. 1920, 9,096; 1930, 29,472.

**ALHARIZI, JUDAH.** See HARIZI, JUDAH BEN SOLOMON.

**ALI BABA**, hero of "Ali Baba and the Forty Thieves" in the *Arabian Nights*. A poor woodcutter, Ali Baba becomes suddenly wealthy when he discovers the "Open Sesame" to a robbers' cave. When these robbers try to thwart Ali Baba, his servant Morgiana kills the 40 thieves with boiling oil.

**ALIBAMU**, a tribe of the Muskhogean linguistic stock, closely related to the KOASATI. They were members of the CREEK Confederacy and formerly lived in southern Alabama. Their home at the time of discovery was along the Alabama River near the junction of the Coosa and Tallapoosa to which place they are assumed to have migrated from a more west-

ern habitat. In the 19th century they were scattered, some going to western Louisiana, others to what is now Oklahoma, and some to Texas. They were extremely warlike in their early contacts with the whites. They appear to have been both agriculturists and hunters.

The name is also applied to a town of the Creek Indians on the north fork of the Canadian River.

**ALIBI**, in law, a mode of defense in a criminal prosecution, whereby the accused, in order to show that he could not have committed the crime, seeks to show that he was in another place at the time it was committed. It is not in strictness a defense but is one way of rebutting the evidence adduced by the prosecution.

**ALICANTE**, a city of southeastern Spain, capital of Alicante province, located at the foot of a crag surmounted by an old citadel. It has a fine harbor and promenade, an interesting Baroque city hall, churches and palaces, a picture gallery and library. The newer sections of the city have a modern appearance. The chief occupation is transit trade. Alicante was Moorish from 718 to 1304. Est. pop. 1929, 69,793.

**ALIDADE**, the upper portion of a THEODOLITE or a TRANSIT. The assembly consists of the inner center; upper plate, with attached VERNIERS; standards; rotation axis; and TELESCOPE. The term is sometimes applied also to the corresponding parts of the vertical circle, that is: the vernier supporting arm and any attached levels and reading microscopes. Alidade also covers the instrument that is used in connection with the plane table, consisting of a telescope mounted in trunnions which are on short standards (like a theodolite); these are supported by a vertical pillar which is rigidly attached to a metal blade. Two of the edges of this blade are bevelled straight-edges made parallel to the vertical plane of motion of the telescope and used for drawing lines on the map in the direction of the sight. With this instrument vertical angles and stadia measurements may be made.

**ALIEN**, a citizen of another state, or a person owing allegiance to a foreign country; a foreigner. In English law it implies especially to one born without the allegiance of the King. Each state has jurisdiction over aliens within its borders. They are generally entitled to the same protection of their personal rights as a citizen. By treaty, aliens may resort to another country and transact business and commerce without molestation. Aliens lawfully admitted into a country are generally given the same police protection and the same safety as a citizen. In most countries there is no distinction as to the exercise of civil and property rights. Aliens owe a temporary allegiance to the country of sojourn or residence. Alienage generally operates to exclude a foreigner from certain privileges, such as public office. The government of a country has the clear right to regulate the ownership of property by aliens, to admit or exclude them from the country, and to prescribe the conditions for admission to CITIZENSHIP through NATURALIZATION.

## ALHAMBRA



### THE ALHAMBRA'S FAMOUS FOUNTAIN

The fountain of the Court of the Lions in the Alhambra, Granada, Spain, a fine example of Moorish art dating from the 14th century.



**ALIEN AND SEDITION ACTS**, four acts of Congress, 1798, designed by the Federalist Party, then dominant, to repress the outspoken criticism of the Administration leaders and policies. Believing that the chief strength of the REPUBLICAN PARTY was the foreign element, the Federalists enacted a Naturalization Act fixing 14 years of residence as a qualification of foreigners for citizenship; an Alien Enemies Act, providing for the treatment of aliens with whose government the United States might be at war (relations with France were strained at the time); an Alien Act giving the President power to order the removal from the country of aliens considered to be dangerous; and a Sedition Act, imposing penalties of as much as \$5,000 fine and five years' imprisonment for conspiring against the Government or interfering with the operation of its measures, and penalties of as much as \$2,000 fine and two years' imprisonment for printing scandalous material concerning the Federal Government, the President or Congress. The Alien Act was to expire in two years, the Sedition Act in 1801. Under the Sedition Act several Republican editors were prosecuted for libeling the Government and President John Adams. The acts and the prosecutions under them aroused intense resentment, invoking the VIRGINIA AND KENTUCKY RESOLUTIONS, and foreshadowing the downfall of the Federalist Party.

**ALIENATE**, in law, the transferring of ownership of PROPERTY to another. The word, used in deeds, does not specify the quantity of the property, nor does it impart WARRANTY. Alienate used with the words "transfer and dispose," in a CHARTER granted to a corporation, includes the power to MORTGAGE. In one case the court ruled, "Alienable and alienation . . . include the disposition of real estate by will as well as by conveyance. Where the acts of Congress, and the agreements under consideration were enacted, they restricted the disposition of the property of the Choctaws and Chickasaws by will as well as by deed." Alienate is also used in reference to affections, as to alienate affection, i.e., withdraw affection from one person legitimately entitled to it by another.

**ALIEN CORPORATION**, in law, a foreign corporation. When STATUTES mention corporations, they include foreign corporations, unless particularly excepting them. Otherwise they have the same rights and obligations as domestic corporations. CORPORATIONS, being solely creations of the law, have no rights except those granted by law (*see* CORPORATION LAW) and the rights obtained in foreign states are not necessarily those which they have in the state of their creation, but solely those allowed them by comity. One disadvantage they suffer in some states is that, when sued, their property can be attached. *See also* ATTACHMENT.

**ALIEN ENEMY RIGHTS.** Alien enemies are those in the military or naval service of an enemy state, seamen on the merchant-ships of an enemy state, army followers, persons living in an enemy country, persons living in territory under military occupation, citizens of one enemy state living within

another enemy state, and neutrals doing business with the enemy country. Enemy aliens (*see* ALIEN) generally have no civil rights or privileges, unless under the protection of the government, and residing in the country with its permission. Trading with the enemy is generally prohibited, but a certain amount of enemy trade is allowed under a system of licenses. Moreover, enemy aliens generally have no status before the courts of a country. However, registering as an enemy alien and being licensed to trade, often confers the right to sue. A reasonable time to withdraw from a country has been recognized in international law. Permission to remain depends either on treaty arrangement or on the sufferance of the sovereign.

C. E. MA.

**ALIMENTARY CANAL.** In the simpler forms of aquatic animal life, food dissolved in the water simply passes into the cells of the animal as the animal comes in contact with the nutritive solution. If the material is in a form unsuitable for immediate use, digestion within the cell renders it available. Many of the simpler forms can surround and engulf particles of matter, and then subject the food particles to such digestion as will supply the products necessary for maintenance, growth and reproduction. With the increasing complexity of the animal life, the organism develops a passage throughout its length into which it takes food or nutritive matter already in solution. The tube or canal possesses the power of digesting the material which passes through it.

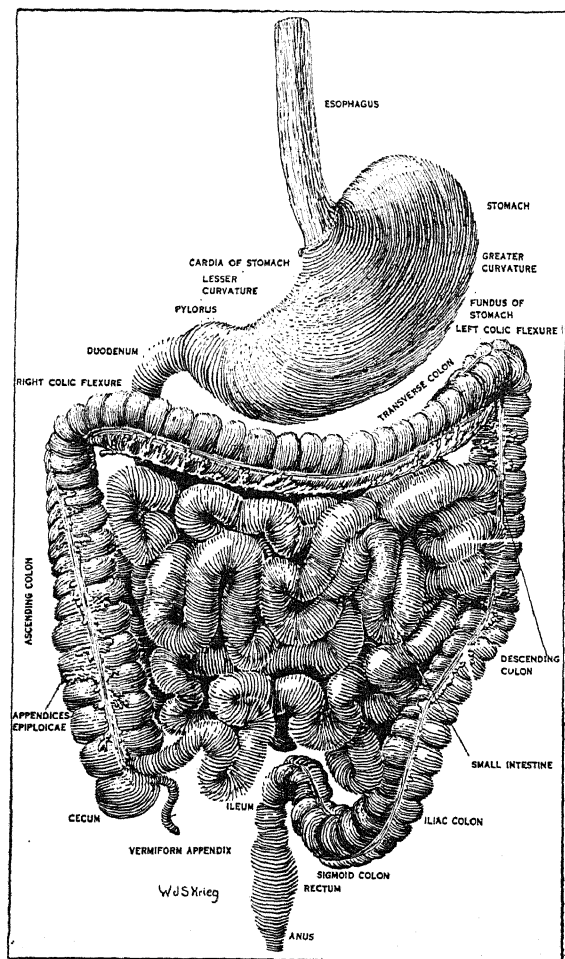
In the *mouth*, the cutting, tearing, or grinding teeth reduce the food to a pulpy mass, since a watery fluid, the *saliva*, secreted by three pairs of glands, is freely mixed with the fluid during the act of *mastication* or chewing. The digestive power of the saliva on starches is of minor value even to those animals which possess an active saliva.

The *stomach*, which receives the pulpy food mass from the mouth after its passage through the tubular *esophagus*, is a dilated portion of the alimentary canal. The cells lining it digest particularly protein foods (such as lean meat and similar chemical substances derived from plants) by virtue of the pepsin and hydrochloric acid which they secrete and which become thoroughly mixed with the proteins due to churning power of the strong muscular walls of the stomach.

Below the stomach other digestive glands pour their juices into the alimentary canal or *small intestine*, as this part of the canal is called. Of these the *pancreas* is the most important since its secretion, the *pancreatic juice*, digests with the greatest ease not only proteins but the other two types of food, namely, carbohydrates (such as starches), and *fats* of animal or vegetable origin. The *liver* is classed as a digestive gland essentially because its secretion, the *bile*, greatly accelerates the digestion of the fats by the pancreatic juice. Many of the simpler chemical products formed by action of the digestive juices pass through the walls of the alimentary tract. Others are made still more serviceable to the organism by

further digestion during their passage through the walls of the canal.

In any case, the products passed through the canal are absorbed into the blood or lymph vessels. Reaching the general circulation in this manner, they become available to all the organs and tissues of the body which either use the absorbed products suitable for their own purpose, or store them for future use. The process of digestion is greatly expedited by the movement of the intestinal wall which mixes the



HUMAN ALIMENTARY CANAL VIEWED ANTERIORLY

digestive juices with the foods and, by transporting the digested material progressively downward to lower levels of the alimentary canal, allows of continuous digestion and absorption throughout its entire length of 20 feet.

The next 5 feet of bowel constitute the large intestine. Its function consists essentially in the absorption of the remaining nutritious material and water. The indigestible residue desiccated to a proper consistency in its various parts (*ascending, transverse and descending colon*) eventually reaches the *rectum*, whence it is expelled to the exterior in the act of *defecation*.

When the stomach is empty, it executes powerful contractions which give rise to the sensation of hunger. The *appendix*, located near the junction of the small with the large intestine, is the remains of what in some animals still exists as a large blind pouch, the *caecum*. See also DIGESTIVE SYSTEM. A. B. L.

**ALIMONY**, an allowance paid by husband to wife and, less frequently, by wife to husband, as a result of Divorce proceedings. Temporary alimony, pending judgment, is often allowed. When a divorce is granted by the court, the payment of alimony is made permanent. Alimony is based upon the COMMON LAW obligations of the husband to support his wife, which is not removed by her obtaining a divorce. In the states of North Dakota, Ohio and Massachusetts, a husband under certain circumstances has the right to alimony. There is no separate action for alimony. Ecclesiastical law recognizes alimony in separation suits.

**ALINEMENT**, the act of alining points, as when points are placed in the vertical plane of motion of the telescope of a TRANSIT as defined by its vertical cross-hair. Also the term applied to the horizontal directions and distances of a railway or a highway line as distinguished from the system of grades, or the profile, which deals with the vertical element.

**ALIPHATIC COMPOUNDS**, derivatives of the hydrocarbon METHANE ( $\text{CH}_4$ ) comprising the open-chain or acyclic division of the hydrocarbon compounds in contradistinction to the closed-chain or cyclic compounds. The aliphatic or fatty compounds are distinguished from the AROMATIC COMPOUNDS by the fact that hydrogen is not readily replaced directly. The aliphatic group of hydrocarbons is divided, according to the chemical properties of its members, into four main classes: paraffins, olefines, acetylenes, and di-olefines. (See ACETYLENE; OLEFINE COMPOUNDS; PARAFFIN COMPOUNDS.) The members of any of these divisions bear a close resemblance. The paraffin group hydrocarbons are considered as being saturated, as exemplified by carbon tetrachloride ( $\text{CCl}_4$ ) formed when chlorine acts on methane. The simple members of the paraffin group are gases; the complex are liquids of low and high boiling points and solids of low and high melting points progressively. Olefines are termed unsaturated hydrocarbons and they readily absorb hydrogen, and combine with bromine or chlorine. ETHYLENE (olefine) ( $\text{C}_2\text{H}_4$ ) is a common member of this group. In the acetylenes, the carbon atom appears to be bivalent and will combine with more hydrogen. Also, the hydrogen atoms may be replaced by metals. The di-olefines are isomeric with the homologues of acetylene, butadiene ( $\text{CH}_2 = \text{CH} - \text{CH} = \text{CH}_2$ ) being isomeric with ethylacetylene ( $\text{CH}_3 - \text{CH}_2 - \text{C} \equiv \text{CH}$ ). See also CARBON COMPOUNDS.

**ALQUIPPA**, a steel-manufacturing borough in Beaver Co., southwestern Pennsylvania. It is situated on the Ohio River, 20 mi. northwest of Pittsburgh; it is served by the Pittsburgh and Lake Erie and the Aliquippa and Southern railroads. In 1929 the retail

trade amounted to \$9,997,839. The vicinity is good farming country. The boroughs of Woodlawn and Aliquippa consolidated as Aliquippa in 1928. Pop. 1920, 2,931; combined 1920, 15,426; 1930, 27,116.

**ALIQOT PART**, an integral factor of a whole number, including 1 but not the number itself. For example, the aliquot parts of 6 are 1, 2, and 3. The word *aliquot* is Latin, meaning so many or some. See AMICABLE NUMBERS; NUMBER; FACTOR.

**ALIZARIN**, an important dye obtained in nature from madder root, and prepared synthetically from ANTHRAQUINONE, a compound of hydrogen, carbon and oxygen. It has the general formula,  $C_{14}H_8O_2(OH)_2$ . It belongs to the class of dyestuffs (see DYES, SYNTHETIC) known as adjective and poly-genetic, as it produces different colors when dyed upon yarn with different mordants. Fast and brilliant shades of scarlet, prune, maroon, violet and black can be produced upon cotton or linen with various mordants. Synthetic alizarin is a bright orange-colored substance usually encountered as a 20% paste.

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**ALKAHEST**, one of the minor objects of the search of the alchemists, a liquid capable of dissolving all other substances and possessing valuable medicinal properties. This idea obviously carried its own refutation, since no vessel could hold such a fluid.

**ALKALI-GRASS** (*Distichlis spicata*), called also SALT GRASS, a stiff, erect, perennial grass found widely in saline and alkaline soils in North and South America and also in Australia. The stem, 6 to 24 in. high, bears two vertical ranks of rigidly ascending leaves, and smooth flowering spikelets crowded in narrow clusters. It is utilized to a limited extent for grazing.

**ALKALIMETRY**, the analyzing of a solution to determine the amount of free alkali in it. This is usually done by neutralizing the solution with a known quantity of an acid (see CHEMISTRY, ANALYTICAL) and making proper calculations from the equation of the reaction. See also ACIDIMETRY.

**ALKALIS**, strictly speaking, the HYDROXIDES of the alkali metals, namely: LITHIUM, SODIUM, POTASSIUM, RUBIDIUM, and CAESIUM. The term is also applied to the oxides of these metals and is loosely but commonly employed as a synonym for BASES.

For the manufacture of alkalis, see CAUSTIC SODA; LIME; SODA.

**ALKALI SOILS**, characterized by a high content of sodium sulphate, together with carbonates, chlorides and nitrates of sodium, magnesium, calcium, iron and potassium. These alkaline salts render the soils sterile, accentuating the barrenness of the arid, desert regions in which they usually occur. In humid regions the circulating ground waters carry such salts away in solution. In dry climates, however, occasional rainfall merely serves to dissolve them from Rock and soil-forming minerals and to concentrate them in the soil. Alkali soils are common in the Great Basin region of the United States. See also SOIL.

**ALKALI-WEED** (*Cressa cretica*), a low, diffuse perennial of the morning-glory family, growing in alkaline soils in many warm regions. It is common in parts of California and Arizona, especially in the San Joaquin Valley, often covering thousands of acres. The stems form dense tufts and bear small white flowers.

**ALKALOIDS**, naturally occurring basic nitrogenous compounds, possessing marked physiological activity. They occur both as liquids and solids which are generally only slightly soluble in water, but are more soluble in organic solvents such as chloroform, ether, and alcohol. Most of them possess a bitter taste. Although their aqueous solutions are basic, the alkalinity varies over a wide range. As basic substances, they react with acids to form salts which are usually crystalline and more soluble in water than the free base, but usually less soluble in the organic solvents. In general, the physiological action of the salts is the same as that of the free base. Alkaloids are precipitated from solution or solution of their salts by various reagents. Among the alkaloids in common use are atropin, cocaine, morphine, quinine. O. K.

**ALKMAAR**, a city in the Dutch province of North Holland, located among drained marshes on the North Holland Canal. Noteworthy buildings are the Church of St. Lawrence, 1470-98, and the city hall with museum, both in the Gothic style of architecture. Alkmaar has salt works and carries on trade in cheese, cattle and grain. In 1573 it was besieged in vain by the Spaniards. In 1799 an agreement was concluded between the French General Brune and the Duke of York, accordingly the British and the Russians withdrew from Holland. Three and a half miles to the west is the ancestral castle of the Counts of Egmont, destroyed by the Spaniards. Pop. 1930, 28,374.

**ALLAH**, the Moslem name for God, or, literally, The God, is an Arabic word which embraces all the names by which Moslems designate the Deity. Mohammed first adopted the word and put into it its full meaning.

**ALLAHABAD**, capital of the United Provinces of Agra and Oudh, British India, about 80 mi. from BENARES. It is situated at the junction of the Ganges and Jumna rivers, and is on the main line from Calcutta to Cawnpore. Allahabad was taken from the Mogul rulers by the British in 1765, but restored in 1771, and not occupied again by the British until 1801. Great numbers of Hindus come to Allahabad to bathe in the Ganges, and obtain purification from its sacred waters. There are several ancient mosques and palaces in Allahabad, and a number of modern government and educational buildings and churches. Politically, Allahabad has become a center of the Indian National Movement. Pop. 1921, 157,220; 1931, 183,931.

**ALLAN-A-DALE** appears as a minstrel in the ballads of Robin Hood. Sir Walter Scott uses him as such in IVANHOE.

**ALLARGANDO**, a term in musical EXPRESSION synonymous with largando, an Italian word derived



from largo, meaning roomy or spacious, and thus implying a leisurely or stately manner.

**ALLBUTT, SIR CLIFFORD** (1836-1925), noted British physician, was born in Yorkshire, July 20, 1836. After a general education at Cambridge, he studied medicine at St. George's Hospital, London. Post-graduate study in Paris was followed by a large practice in internal medicine in London, including also extensive research on the nervous system and on the history of medicine. He invented the short clinical thermometer. After serving as consulting physician to many institutions, he became regius professor of physics at Cambridge in 1907, which position he held until his death in 1925. His published works include not only many books on technical aspects of medicine, but also the editing of a system of medicine and of a system of gynecology, and the writing of such historical and general works as *Historical Relations of Medicine and Surgery* (1905), *Greek Medicine in Rome* (1921), *Science in the School* (1917), and *Notes on the Composition of Scientific Papers*, third edition, 1923. M. F.

**ALLEE, WARDER CLYDE** (1885- ), American zoologist, born in Bloomington, Ind., June 5, 1885. He graduated from Earlham College, 1908, and took his M.S. and Ph.D. degrees from the University of Chicago, 1910 and 1912. His teaching career began as an assistant in zoology at the University of Chicago, 1910-12. Allee served as professor of biology at Lake Forest College, 1915-21; and as assistant professor, 1921-22, associate professor, 1923-28, and professor of zoology, 1928, at the University of Chicago. He has published many scientific papers, which include seasonal succession in ponds, rheotaxis in isopoda, the behavior of osopoda, animal aggregations and the behavior of animals in tropical rain forests. With his wife, Marjorie Hill Allee, he wrote *Jungle Island*, 1925.

**ALLEGANY STATE PARK**, a tract of 65,000 acres in Cattaraugus Co., N.Y. The nucleus of the present park was formerly a state forest experimental station of 1,200 acres, established as a state park in 1921. This extensive park is situated in the Allegheny plateau region. Its mountain ridges average 2,300 ft. and its valleys 1,500 ft. altitude; the region is forested and sections are reserved as game sanctuaries.

**ALLEGHENY COLLEGE**, a coeducational institution, at Meadville, Pa., controlled by the Methodist Episcopal Church. It has productive funds of \$1,456,546. Bentley Hall, erected in 1820, five years after the foundation of the college, is a significant example of American architecture. Reis Memorial Library, founded in 1902, contains 80,000 volumes. In 1931-32 there were 586 students enrolled, and a faculty of 45 headed by Pres. WILLIAM P. TOLLEY.

**ALLEGHENY MOUNTAINS**, the northwesternmost division of the Appalachian system, running generally from northeast to southwest across Pennsylvania, Maryland, Virginia and West Virginia. This division includes part of the long chain of ridges which parallel the Blue Ridge to the east and form

the central feature of the great Appalachian valley; and the Allegheny Front, a bold escarpment forming the eastern face of the Allegheny plateau which slopes gradually down to the Great Lakes region in the north and the Mississippi plains in the central states. It extends to the eastern boundary of Kentucky from which point it continues as the Cumberland plateau.

The Allegheny Mountains are remarkable for their regularity, rectilinear direction and evenness of outline, there being no dominating peaks. They form the watershed dividing the drainage basins of the Mississippi valley and the Atlantic seaboard with heights varying from 1,500 to 1,800 ft. in Pennsylvania and 4,000 feet in Virginia and West Virginia. Some of the streams tributary to the Atlantic traverse the mountains in deeply incised water gaps.

The region of the Alleghenies is rich in coal and iron deposits which have been extensively worked in Pennsylvania. Other resources include oil, natural gas and limestone which is found in quantities in the ridges and the valley floors. The plateau area is important for its forests of beech, ash, white oak, hickory and white pine. This uplift which in early Colonial days impeded emigration to the west, is now crossed in several places by railroads and highways.

**ALLEGHENY RIVER**, a river of Pennsylvania, rising in Potter Co. at about 2,500 ft. above sea level. From its source it flows northwestward, makes a short detour into New York State, and upon reentering Pennsylvania follows a curving course southwestward to join the Monongehela at Pittsburgh. The combined stream is the Ohio. The length of the Allegheny is about 325 mi. not including its principal affluents, the Clarion, Red Bank and Conemaugh from the east and Oil and French creeks from the west. It has an average fall of 2.2 ft. per mi. and a rapid current but its water power has not been developed because of plentiful and cheap fuel in its basin. The channel is being improved for navigation which is now possible for 200 mi. The basin of the river, covering 11,580 sq. mi., is a rolling, hilly region rich in coal, oil, gas and building stone.

**ALLEGIANCE**, as defined by Blackstone, "the tie or ligament which binds the subject to the King, in return for that protection which the King affords the subject." In republics, the relationship is similar as between the government and the citizen, binding him to observe all laws not inconsistent with the laws of nature. Allegiance is subdivided. A person has natural allegiance to the country of his birth. This is perpetual unless forfeited by misbehavior or renunciation to give allegiance to another country. An ALIEN may be naturalized (*see* NATURALIZATION LAWS), thus acquiring allegiance. There is also a local allegiance required even of a casual visitor. Although he conforms to the laws of the country visited, and in return, receives its protection, the visitor in no way renounces allegiance to his own country, or forfeits her protection against injury received abroad. Allegiance does not depend upon ownership of land. A leading case in the U.S. holds: "As to



allegiance, it is indeed due from every citizen to the state, but it is a political obligation, and is as binding on him who enjoys the protection of the Commonwealth, without owning a foot of soil, as on him who counts his acres by hundreds and thousands." Under the COMMON LAW, none could renounce allegiance except with consent of the sovereign. Now, by STATUTE in the U.S., England and certain other countries, the subject may change his allegiance at will.

**ALLEGORY**, as a literary form, a story or drama in which the characters and the action are used as symbols of an underlying thought or system of thought. In Bunyan's *PILGRIM'S PROGRESS* Christian's journey from the City of Destruction to the Celestial City is obviously the progress of the soul to spiritual reality. The allegory is a very ancient form of expression, especially in the Orient; the Scriptures are filled with them. The noblest are the parables spoken by Christ. Plato's allegory of the soul, a charioteer drawn by a white and black horse is the first mentioned Greek allegory. Dante's *DIVINE COMEDY* was the great epic allegory of the Middle Ages. *Everyman* is an example of the English allegorical drama. These have all dealt with moral and spiritual problems.

Political propaganda and comment on historical and current events have also been clothed in allegory, as in Spenser's *Faerie Queene* and Jonathan Swift's *Tale of a Tub*. Clement of Alexandria (c. 150-220) was one of the first eminent theologians to interpret the scriptures in allegory.

**ALLEGRO**, an Italian term in musical EXPRESSION used to signify a rapid tempo, midway between *ANDANTE* and *PRESTO*. In the *SONATA* and *SYMPHONY* the first movement commonly bears this title.

**ALLELUIA** (Hebrew for "all hail to Him who is"), an expression of joy and praise found in the Psalms and in the Revelation of St. John, 19:18. It is in frequent use in liturgies, especially at Eastertide, when it follows every antiphon, versicle and responsory, and is also frequently repeated at parts of the Mass.

**ALLEMANDE**, an old dance popular throughout France in the 17th and 18th centuries, and which also found favor in Germany where it was sometimes known as a *Deutscher Tanz*. It was usually taken at a slow tempo, and examples of it are in both duple and triple meter. It lent its name to what was usually the first movement of the *SUITE* of BACH and HANDEL. Here it consisted of two sections, both repeated, taken at a moderate tempo in duple meter and commonly beginning on a short note or upbeat.

**ALLEN, ARTHUR AUGUSTUS** (1885- ), American ornithologist, born in Buffalo, N.Y., Dec. 28, 1885. He graduated from Cornell University in 1907, and took an A.M. degree, 1908, and a Ph.D. degree, 1911. His teaching career began as an instructor in zoology at Cornell in 1909. He advanced to an assistant professorship of ornithology in 1915 and to a full professorship in 1924. Dr. Allen accompanied an American Museum of Natural History expedition

to South America, 1912, and he has been an associate editor of *Bird Lore*.

**ALLEN, ETHAN** (1739-89), American Revolutionary soldier, was born at Litchfield, Conn., Jan. 10, 1739. Little is known of his youth. He took up land in the New Hampshire Grants, now Vermont, probably by 1769. Although celebrated as a Revolutionary soldier, Allen's greatest interest lay in the autonomy of the State of Vermont and his Green Mountain Boys were organized against New York. In 1775 the Vermont-New York controversy being put in abeyance by the war, Allen led a force against Fort Ticonderoga and captured it on May 10. On an expedition to Canada he was seized by the British near Montreal, Sept. 25, 1775. Upon his release, May 6, 1778, Washington made him Colonel. His *Narrative of Col. Ethan Allen's Captivity*, 1779, is the best known piece of prison writing from the Revolution. Between 1779 and 1783 Allen, now Brigadier-General of Vermont Militia, carried on negotiations with Canada with a view to obtaining aid in establishing Vermont's autonomy; in the first-named year he published also *A Vindication of the Inhabitants of Vermont to the Government of New York and Their Right to Form an Independent State*. In 1787 he settled in Burlington, Vt., where he died Feb. 11, 1789.

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**ALLEN, JAMES LANE** (1840-1925), American novelist, was born near Lexington, Ky., Dec. 21, 1849. After some years of teaching and writing, he devoted all his attention to literature. His early works deal with pre-war Kentucky and include *The Blue Grass Region of Kentucky*, 1892, *A Kentucky Cardinal*, 1894, *Aftermath*, 1895, and *The Choir Invisible*, 1897. Among his later, more generalized novels are *Mettle of the Pasture*, 1903, *Bride of the Mistletoe*, 1909, and *The Heroine in Bronze*, 1912. Allen died in New York City, Feb. 18, 1925.

**ALLENBY, SIR EDMUND** (1861- ), British field marshal, was born on Apr. 23, 1861, at Brackenhurst, Southwell. During his youth he saw considerable active service in South Africa. At the outbreak of the World War he was sent to France in command of a cavalry division. Later he participated in the battle of the Somme. In June 1917 he was appointed commander of the British forces in Palestine and Egypt, and in this capacity undertook to take the Holy City from the Turks by the Christmas of that year. On Dec. 9, 1917, he entered Jerusalem at the head of the victorious British forces. Resuming his campaign against the Turks the following year, he captured Damascus, Beirut and Aleppo. At the end of the war he was made a field-marshal, raised to the peerage as Viscount Allenby of Megiddo and Felixstowe, and given a money grant of £50,000 by Parliament. In 1919 he was appointed British High Commissioner in Egypt. This post he held until 1925, administering his office fairly and impartially; however, the demand of the Egyptians for in-

dependence caused considerable unrest during his term.

**ALLENSTEIN**, a city in East Prussia, situated on the Alle River. It has an old castle, and a church of the 14th century. The astronomer Copernicus lived in the castle as governor, 1516-24. It trades in grain and lumber and also has cement mills and machine, furniture and match factories. First mentioned in 1348, it was occupied by Russian troops Aug. 28 and 29, 1914. Pop. 1925, 34,731.

**ALLENTOWN**, a city in southeastern Pennsylvania, the county seat of Lehigh Co. It is situated on the William Penn Highway and on a new short route between New York, Harrisburg and Pittsburgh, and is served by four railroads. The city is an industrial center with a factory output worth about \$125,000,000 in 1930. The principal manufactures are broad silk, automobile trucks, cement, mining machinery, steel, steel tools, shoes and cigars. The retail trade in 1929 amounted to \$60,140,557. The city is the seat of Muhlenberg College for men and Cedar Crest College for women. Allentown was founded in 1762. It became the county seat in 1812 and was chartered as a city in 1867. The Liberty Bell was hidden here during the American Revolution. Eight miles north of the city is Trexler Game Preserve of 3,000 acres containing buffalo and elk. Allentown is in the center of a rich agricultural section producing potatoes, peaches, corn and wheat. Pop. 1920, 73,502; 1930, 92,563.

**ALLERGY**, also called anaphylaxis or protein sensitivity, is a term applied to a violent reaction of a patient to a foreign protein. This protein may be taken as food, inhaled as dust, or absorbed through exposed mucous surfaces. The phenomenon of allergy or anaphylaxis can be reproduced in lower animals. For example, if a guinea-pig be injected subcutaneously with a small quantity of horse serum, and two to three weeks later be reinjected with the same serum, it is likely to show signs of great distress. The animal becomes restless, seems to itch, the hair becomes ruffled, the thorax is dilated, respiration is difficult, convulsions appear, and death may result. Equally distressing though quite different symptoms are produced in other animal species. Human symptomatology may resemble that of any animal group.

The exciting substance is usually, though not invariably, a complete protein. (See **PROTEIN**.) Characteristic reactions are not produced by the first injection, unless the animal has an inborn sensitivity to that protein or has become hypersensitive from other causes. Sensitivity is usually, though not invariably, specific; that is, the protein used in the second dose must be physiologically the same as that used in the first. This does not necessarily imply chemical identity.

Various theories have been proposed to explain protein sensitivity. The cause of the reaction is generally admitted to be some unknown physico-chemical perversion of vital colloids. All tissues and body fluids presumably take part in the reaction. In guinea-pigs,

the dominant symptoms are those produced by spasm of the bronchial musculature. In rabbits the accompanying cardiovascular reactions are dominant. Hepatic reactions dominate canine anaphylaxis.

Allergy has wide implications in clinical medicine. **HAY FEVER**, **ASTHMA**, serum sickness, food and drug hypersensitiveness are all dependent upon inherited or acquired sensitivity to certain proteins. In hay fever inhaled pollens cause irritation of the nasal mucous membranes. Asthma is usually due to the same local irritation, plus spasm of the smooth muscle which surrounds the passages to the lungs. Asthmatic attacks are also produced by eating specific proteins. Other allergic symptoms are: itching, the formation of blisters or wheals, shivering, vomiting, migraine and prostration.

It is possible to determine whether or not a person is hypersensitive to a given protein by introducing a minute amount under the skin. If hypersensitive, a local red wheal is developed. In this way one can identify and avoid proteins offensive to the patient. This is not as practical as it seems at first, for he may be sensitive to a large number of proteins, some of which are missed in routine tests, or to proteins which it is impractical for him to avoid. The patient can usually be immunized temporarily against a specific protein, so that for several months he will not react abnormally to a given irritant. This immunization is usually effected by repeated injections with minute doses of the protein or group of proteins to which he is found to be hypersensitive by cutaneous tests. See also **IMMUNITY**; **SERUM**. W. H. M.

**ALLIANCE**, a treaty or agreement between independent states, under which a league or association is formed to accomplish certain objects through combined action. Examples are the Treaty of Alliance between France and the United States, under which American independence was attained; the **ANGLO-JAPANESE ALLIANCE** for the neutralization of Russia's aims in the Far East; and the dual Entente of France and Russia as opposed to the **TRIPLE ALLIANCE** of Germany, Austria and Italy. The United States became in the World War an "Associated" rather than an "Allied" power. The Allies were the states in alliance against Germany. C. E. MA.

**ALLIANCE**, a city in western Nebraska, the county seat of Box Butte Co., situated in a basin between the sandhills and the Pine Ridge, a region of rich alluvial soil, about 35 mi. northeast of Bridgeport. It is the headquarters of four divisions of the Chicago, Burlington and Quincy Railroad, which maintains extensive local shops. There is an emergency landing field. Wheat, potatoes and cattle are the principal products of this region. The city is the center of the certified seed potato industry, and has packing houses, a cereal mill, a creamery and harness, leather goods and sheet metal factories. Alliance was chartered as a first class city in 1914. Pop. 1920, 4,591; 1930, 6,669.

**ALLIANCE**, a city of northeastern Ohio, in Stark Co., located at an elevation of 1,229 ft. on the Mahon-

ing River, 17 mi. northeast of Canton. The New York Central and the Pennsylvania railroads serve the city, and the Alliance aviation field is in the vicinity. Alliance is in an agricultural region raising grain, live stock and poultry, and having dairying interests and natural resources of oil, gas and coal. In 1929 the city's manufactures, valued at approximately \$26,000,000, included accounting registers, traveling cranes, face bricks, china and pottery, stoves, drop-forgings, and steel products. The retail trade during 1929 amounted to \$13,430,812. The city is the seat of Mount Union College, established in 1846, which in 1911 absorbed Scio College established in 1857. Alliance was first settled in 1805; it was incorporated in 1889. Pop. 1920, 21,603; 1930, 23,047.

**ALLIBONE, SAMUEL AUSTIN** (1816-89), American bibliographer, was born at Philadelphia, Pa., Apr. 17, 1816. He is best known for his *Critical Dictionary of English Literature and British and American Authors*, published 1854-71. In 1867-73 and in 1877-79 he acted as editor for the American Sunday School Union, and was subsequently librarian of the Lenox Library, New York City. Allibone died at Lucerne, Switzerland, Sept. 2, 1889.

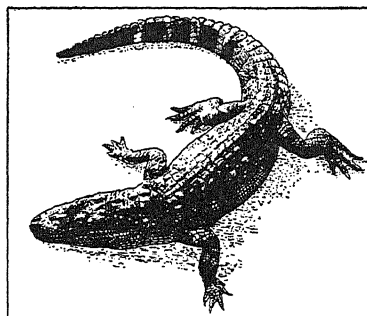
**ALLIES.** By the Pact of London on Sept. 4, 1914, the TRIPLE ENTENTE between Great Britain, France and Russia was converted into a wartime alliance whereby each signatory promised neither to conclude a separate peace nor to issue a statement of peace demands without previously consulting with the other two signatories. Thereafter these three powers came to be known as "the Allies." This pact was also adhered to by Italy, on Sept. 5, 1915, and in the popular mind the term Allies or Allied Powers soon came to mean all of the 32 states which either declared war on or else severed relations with one or more of the CENTRAL POWERS between 1914-18. In the final peace treaties of the World War, the official designation of the allies is "Allied and Associated Powers."

**ALLIGATOR**, a term grouping in its popular sense the South American caimans (*Paleosuchus* and *Caiman*) together with the two species of the genus *Alligator*, one confined to sections of the lower Yangtze River Valley, the other to the southern United States from the Atlantic coast westward into Texas. The North American alligator (*A. mississippiensis*) is readily distinguished from the American crocodile by the fact that in the alligator the fourth tooth of the lower jaw fits into a pocket in the upper instead of into a groove as in the crocodile. The ranges of these two crocodilians overlap in extreme southern Florida, the only part of the United States inhabited by the crocodile.

Although the North American alligator was formerly common in the larger rivers and lakes of the southern states, wanton destruction has driven it to the more remote parts of large marshes and inaccessible swamps of the coastal plain. Persecution has not only reduced the numbers of alligators but their maximum size as well. Numerous reliable records show that before 1850 15-ft. examples were common,

but to-day it is difficult to find one 12 ft. long. When hatched an alligator is about 8 in. long and captive specimens grow approximately a foot a year, popular belief to the contrary notwithstanding.

Sexual maturity is reached from the fourth to the sixth year. From 20 to 60 eggs are produced by a single female and deposited in a nest constructed by her chiefly out of grass and decaying leaves. Alli-



AMERICAN ALLIGATOR

gators subsist on crustaceans, insects, spiders and various vertebrates, especially fishes and turtles. They are not seriously destructive of useful animals and are of some value in destroying harmful creatures, such as alligator-gars and crawfishes. C. H. P.

**ALLIGATOR APPLE** (*Annona glabraris*), called also CORKWOOD, a small tree of the custard apple family native to southern Florida, the West Indies and southward. While closely related to the delicious cherimoya and the sweet-sop, the fruit, which is said to contain a dangerous narcotic, is not eaten. The extremely light wood is used as cork.

**ALLIGATOR-GAR** (*Lepisosteus spatula*), a voracious, carnivorous fish, the largest of the gar family, sometimes attaining a length of 20 ft. It has an elongated, nearly cylindrical body, covered with a bony armor of greenish scales. Its snout is long and beak-like, and the jaws are set with several series of sharp, back-curved teeth. The alligator-gar is found in streams around the Gulf of Mexico, where it preys on other fish. Its flesh is not good for food. See GAR-FISH.

**ALLIGATOR PEAR**, a name formerly given, but now falling into disuse, to the AVOCADO, a valuable fruit widely cultivated in warm regions.

**ALLIUM**, an important genus of the lily family embracing several useful food plants. There are some 300 species widely distributed through the Northern Hemisphere. They are bulbous perennials, usually with a strong, distinctive odor, bearing flat or round-hollow mostly basal leaves and more or less showy clusters (umbels) of white, yellow, purplish or rose-colored flowers, on leafless stalks. Valuable members of the group are the cultivated onion, garlic, leek, chives and shallot. A few also are planted as garden ornamentals. About 60 species grow wild in North America, chiefly in the western United States, some 25 occurring in California. The field

garlic, native to Europe, has spread widely in pastures in the middle states. When eaten by dairy cows it impairs the flavor of spring butter.

**ALLOCUTION**, an address by the pope to the College of Cardinals. The address is affixed to the door of St. Peter's and so published to the world. Allocutions deal with public questions affecting the Catholic Church.

**ALLOMERISM**, a chemical property by which certain substances change their constituency without altering their crystalline form.

**ALLOPATHY**, the practice of medicine by those who are not confined to any single system of treatment, such as chiropractic, osteopathy, naturopathy, or homeopathy, but who use in their treatments any methods which have been shown scientifically to be of merit. The allopath is generally known as a regular practitioner.

**ALLOTROPY**, a chemical term denoting the ability of a substance to exist in two or more forms the properties of which differ. Substances possessing allotropic properties include oxygen, phosphorus, sulphur, carbon, boron, silicon, tin and antimony. Oxygen ( $O_2$ ) with two atoms, may be changed to ozone ( $O_3$ ) with three oxygen atoms. The chemical properties of ozone differ from those of oxygen. Sulphur exists in two distinct liquid forms and in two different solid forms (rhombic and monoclinic sulphur). Carbon exists in the allotropic forms of diamond, graphite and charcoal.

The phenomena of allotropy is explained by the theory that while the atoms of a substance remain always the same, the manner in which the atoms combine with each other varies. Allotropic substances are found in natural form or the difference of arrangement can be brought about synthetically in some cases, as in the production of ozone from oxygen with an electric arc or the production of synthetic diamonds by the sudden chilling of molten iron containing dissolved carbon.

**ALLOWAY**, a hamlet on the north bank of the river Doon,  $2\frac{1}{2}$  mi. south of Ayr, Ayrshire, Scotland, famous as the birthplace of ROBERT BURNS (1759-96). The low thatched cottage in which the poet was born is perfectly described by him in his *Cotter's Saturday Night*; it stands on the road, contains some relics, more of which are at the adjacent Burns Museum. The poet's father, William Burns (or Burness; d. 1784) is buried at the Auld Kirk, the "haunted" church celebrated in *Tam O'Shanter*. In the garden between the Old Bridge and the New Bridge, there is a Burns Monument, built in 1818. Pop., 1931, 800.

**ALLOY**, the solid resulting from the freezing of a mutual solution of metals or metalloids. It may take the form of (1) an intimate mixture of fine-grained crystals of the separate metals present, (2) of a solid solution, (3), of an inter-metallic compound, or (4) of a mixture of two or all of the forms above mentioned. Mercury alloys, which are not all solid at ordinary temperatures, are specifically called AMALGAMS. Alloys generally possess physical and often

chemical properties different from those of any of their constituents.

The purposes of alloys are to produce harder metallic substances (as steel); to produce softer and more easily melted combinations as those used in fire-sprinkler systems (*see* BISMUTH) and safety fuses; to produce more workable material, as in the use of solder; to prevent decomposing action, as rusting (chromium steel for stainless cutlery), and for other uses. Among the alloys in common use are BRONZES, BRASSES, STEELS, SOLDER, TYPE-METAL and BEARING METALS.

**ALLOYS, HIGH TEMPERATURE.** The two epochal developments in the field of METALLURGY, since the production of BESSEMER STEEL in 1857, have been metals for corrosion-resistance purposes and metals for high-temperature uses. The latter has to a degree been an off-shoot of the first as it so happens that most metals which have a composition especially favorable toward resisting corrosion are also well adapted for use at high temperatures, as both depend upon the same main alloy addition, namely, CHROMIUM, for their special qualities.

Though industry had for a long time needed a corrosion-resisting metal, it is only within the past decade that there has been a pronounced call for a metal possessing among other favorable characteristics, high strength at high temperatures. Two of the industries most responsible for this demand have been the power and the oil refining groups.

The phrase "high-temperature service" means: for power plants, temperatures ranging from 750 to 1100° F., and for oil refining, temperatures ranging from 900 to 1300° F. Other miscellaneous uses are: boxes for carburizing, parts for furnaces, and numerous other purposes in which the temperatures employed may go as high as 2200-2300° F.

The physical properties most commonly studied are the short time tension and the "creep" characteristics. Many others might be listed, but these have to date received the greatest attention. Of these two, probably the more important is "creep." This property has been defined by McVetty, as "the plastic deformation or permanent set which results from the continued application of stress at elevated temperatures." One of the methods of stating creep is rate of extension in per cent per inch length of section per 100,000 hours.

In the classification of metals for high-temperature service, one may roughly divide them into five groups, viz., the common non-ferrous metals and alloys, such as copper and the commercial brasses and bronzes; plain carbon steel; low alloy steels; special alloy steels; special alloys.

Copper and the brasses and bronzes which are most commonly used do not show good high temperature properties above 400° F. Plain carbon steel can be used successfully up to 850° F., but its use at higher temperatures, particularly under long sustained, high loads, should not be permitted. Steels to which low percentages of certain alloy additions have been made appear promising for temperatures between 750° F.

and 1100° F. Steels of this type are chrome-tungsten, manganese-molybdenum, chrome-vanadium, chrome-nickel, and many others. Special alloy steels which are finding great favor for high-temperature use are those which carry 16% or more of chromium and 8% nickel. These steels not only have good stability at elevated temperatures, but are pronouncedly resistant to oxidation. Many special alloys have also been developed which have good high-temperature properties. These are mainly of the chrome-nickel type. Many of these are non-workable, MONEL METAL, which is of this class, being an exception. (See also CHROMIUM STEEL; SILICON IRON, HIGH; SILICON STEELS.)

A table of the tensile strength of some representative metals and alloys at high temperatures is given below.

**TENSILE STRENGTH OF FERROUS AND NON-FERROUS ALLOYS AT ELEVATED TEMPERATURES**

Material	Temp. ° F.	Tensile Strength Lb./Sq. In.
<i>Steels</i>	75	53,000
0.13% Carbon Steel, Normalized	800	47,500
	900	38,500
	1000	30,000
0.15% Carbon, 1.75% Manganese, 0.21% Molybdenum, Normalized	75	88,000
	800	85,000
	900	78,000
0.15% Carbon, 3.00% Manganese, 0.21% Molybdenum, Normalized	75	125,000
	800	110,000
	900	106,000
0.05% Carbon, 18% Chromium, 8% Nickel, Quenched	75	82,275
	1000	54,950
0.05% Carbon, 18% Chromium, 10% Manganese, 3% Silicon, Quenched	75	121,450
	1000	61,350
<i>Brass</i>	75	70,000
70% Copper, 30% Zinc	400	65,550
	600	51,500
<i>Bronze</i>	75	68,500
70% Copper, 29% Zinc, 1% Tin	400	65,950
	600	55,800
<i>Monel Metal</i>	75	84,000
70% Nickel, 30% Copper	600	76,000
	800	64,000
	1000	46,000

A. E. WH.

**ALL SAINTS' DAY**, a festival of the Christian Church. It falls on Nov. 1, when the saints, not as individuals but as "one communion and fellowship," to quote the Anglican collect for the day, are honored.

**ALL SOULS' DAY**, a Roman Catholic festival falling on Nov. 2, and devoted to the Mass and prayers on behalf of souls in Purgatory who await the Beatific Vision. The celebration of All Souls' Day is one of the aims of the Anglo-Catholics in the Church of England.

**ALLSPICE**, the name given to the dried unripe berry of the PIMENTO (*Pimenta officinalis*), a highly aromatic tree cultivated in Central America and the West Indies, especially in Jamaica. The flavor of

the spice is supposed to be a combination of those of the nutmeg, cinnamon and clove, hence the name allspice. It is used extensively in medicine and cookery. The berries, about the size of peas, are picked before ripe and dried in the sun. The name allspice is applied also to various other trees and shrubs, as the Carolina allspice, the Japanese allspice, and wild allspice or spice-bush. See also ALLSPICE, CAROLINA.

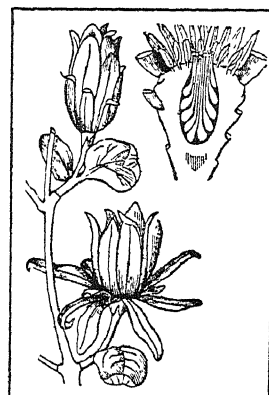
**ALLSPICE, CAROLINA** (*Calycanthus floridus*), a handsome, sweet-scented, ornamental shrub, native to the southeastern United States and widely planted. It grows 3 to 10 ft. high, bearing large deep green leaves which are pale beneath, and fragrant reddish-brown flowers, about 2 in. across, at the ends of leafy branchlets. See also CALYCANTHUS.

**ALLSTON, WASHINGTON** (1779-1843), American artist and writer, was born at Waccamaw, S.C., Nov. 5, 1779. He graduated at Harvard, studied art in London under Benjamin West and went to Paris. After a residence of 4 years in Rome and 6 years in England, he returned to the United States in 1818. He published a volume of poems, *The Sylphs of the Seasons*, 1813, a romance, *Monaldi*, 1841, and some art criticism, but his fame rests upon his paintings, many of which are religious in character. Among these are *The Dead Man Revived*, *Uriel in the Sun*, *The Prophet Jeremiah* and *Jacob's Dream*. The unfinished canvas, *Belshazzar's Feast*, hangs in the Boston Athenaeum. Allston died at Cambridge, Mass., July 9, 1843.

**ALLUVIUM**, sedimentary soil material accumulated by rivers over their flood plains or deltas. It is the product of rock erosion and weathering brought down by the streams and is composed of fine silts, sands and gravels mixed with much decaying material, which gives it extraordinary fertility, as in the flood plain of the Mississippi River. The richness of the alluvial valleys of the Euphrates, the Ganges, the Nile and the Hwang Ho made them the theater of the world's oldest civilizations.

**ALLYL ALCOHOL**, a primary alcohol derived from the unsaturated group of olefine hydrocarbons, occurring in a combined form in oil of garlic. In the pure state it is a colorless liquid with a penetrating, unpleasant odor. Strong oxidation transforms it first into the equally pungent ACROLEIN, then into acrylic acid.

**ALMA**, a city in Gratiot Co. in southern central Michigan, situated on the Pine River, 37 mi. west of Saginaw. Bus lines, airplanes and two railroads serve the city. The chief crops of the region are grain,



CAROLINA ALLSPICE  
Flowering branch and (right),  
half of calyx cup, vertical sec-  
tion, showing structure similar  
to a rose hip

beans and sugar beets; dairying is also important. The city has large packing houses for meat, food and dairy products; and also motor truck, steering wheel, bicycle rim and beet sugar factories. It is the seat of Alma College. The city was incorporated in 1905. Pop. 1920, 7,542; 1930, 6,734.

**ALMAGEST**, the great work of Claudius Ptolemy, written about 140, which embodies all the astronomical knowledge of his time. For centuries it remained the authoritative source of astronomical information.

**ALMAGRO, DIEGO DE** (c. 1470-1538), Spanish conquistador of unknown parentage, who accompanied Francisco Pizarro on his conquest of Peru. He came to America in 1514 and in 1524 aided Pizarro on his first expedition to search for Peru. In 1526 he joined Pizarro and Fernando de Luque in a tripartite contract which called for equal distribution of the honors and gold that might be found by reason of their endeavors. His contribution to the conquest was at first that of supplying Pizarro with reinforcements, but he took part in the battles fought in the third expedition and was present at the trial of the Inca Atahualpa and the capture of Cuzco. He was not satisfied with his treatment at the hands of Pizarro nor with the share of the gold and silver allotted to him, and the enmity of the two men caused serious civil wars. In 1535 he received a grant of land extending for 200 leagues south of Pizarro's. He attempted to conquer Chile but failed and returned to claim Cuzco, which he held to be a part of this territory. The dispute over Cuzco caused a war in which Almagro was defeated and captured. Pizarro then tried him for treason and ordered his execution in July 1538.

**ALMANAC**, a book or table in which are given astronomical data, calendars of the days of the year, records of Church festivals, and a miscellaneous mass of information on a wide variety of subjects. Almanacs are of very ancient origin, and appear to have been first used in the Orient. The Romans used a kind which was apparently not unlike those of modern times. But the earliest of which there is really definite knowledge are those produced during the Middle Ages when their popularity was definitely established. Manuscript copies of many of these productions may be seen in various European libraries and museums. One of these, dated 1292, is believed to be the work of ROGER BACON. The first printed, as distinct from manuscript, almanac appeared from 1450 to 1461, and was the production of the astronomer Pürbach. A specialty of these early almanacs was their prophecies, the extravagance of which led both Henry III and Louis XIII of France to prohibit the insertion of any of a political nature.

To-day the best almanacs contain a vast amount of accurate and useful facts and are widely used for their statistical information. Mention must also be made of purely astronomical almanacs, some of which have enjoyed considerable scientific prestige. They have been published in the United States, England, France and Germany, but the cost of production is so great

that their place in supplying astronomical data is now taken by governmental observatories.

The first general almanac in the United States appears to have been one published in 1687 in Philadelphia. *Poor Richard's Almanac*, compiled by BENJAMIN FRANKLIN, made its first appearance in 1732, and for 25 years thereafter enjoyed wide celebrity both in America and abroad. *The American Almanac and Repository of Knowledge* was published in Boston from 1828 to 1861, and was continued under the title of *The National Almanac* in 1863 and 1864. Almanacs have been compiled by various trade associations, religious denominations and newspapers. In another class are those issued by the manufacturers and vendors of patent medicines and distributed without charge.

Mention must also be made of the *Almanach de Gotha*. First published in 1764 in Germany, it has enjoyed prestige and wide popularity as a source of reference for the genealogy of the reigning, princely and ducal families of Europe and of the sovereigns of certain Oriental states. Originally published in French, since 1871 it has appeared in both French and German.

**ALMANDINE**, a violet or purple variety of the ruby SPINEL, cut as a GEM STONE. Spinel is a mineral found in metamorphosed limestone, serpentine, gneiss and river gravels, and consists of magnesium aluminate, crystallizing in the ISOMETRIC SYSTEM. The color of almandine is probably due to chromium impurities. Gem spinels come from Ceylon, Burma and Siam, and some have been found in New Jersey and New York, in limestone and serpentine. The name is sometimes confused with almandite, a species of GARNET.

**ALMANSA**, a city of Spain in the province of Albacete. A wide grain-growing plain surrounds the city, which is the site of a Moorish citadel. In 1707, the French and Spaniards here gained a victory over the British, Dutch and Portuguese. Est. pop. 1929, 12,000.

**AL MANSUR** (712-75), surname of Abu Jafar Abdallah Mahomet, second caliph of the Abbasides dynasty in Persia, claiming descent from Abbas, uncle of Mahomet. During his reign, Abu Jafar lost control of his province in Spain, but gained additional territory in Asia Minor. In 763 he started the building of Bagdad, his new capital. He died at Mecca in 775.

**ALMA-TADEMA, SIR LAURENCE** (1836-1912), Anglo-Dutch painter, was born at Dronrijp, West Friesland, the Netherlands, Jan. 8, 1836. He studied painting at Antwerp. In the '60s and '70s he established a reputation with his pictures based on Frankish and Egyptian history, having his first success with *The Education of the Children of Clovis* in 1861. In 1870 he came to London to live and 7 years later was made a Royal Academician. Thereafter he devoted himself to subjects from Greek and Roman life, including *Warriors of Marathon*, *Roman Amateur*, *Pyrrhic Dance*, *Heliogabalus* and *Tarquinius Superbus*. His are trustworthy records of the past,



though usually highly sentimental. His sense of craftsmanship was that of the old Dutch artists. Alma-Tadema was knighted in 1899. He died in London, June 25, 1912.

**ALMERÍA**, a city of Spain, fortified capital of Almería province, located on the Mediterranean, at the foot of a hill crowned by a Moorish castle. The congested old city is Moorish in type, but the newer sections are spacious. The city produces sugar and cloth and has an active coast trade, exporting iron, lead, zinc and silver ore and importing chiefly agricultural products. Until it was conquered in 1147 by Alphonse VI, Almería had been for some 400 years a prosperous Moorish city with about 150,000 inhabitants. Est. pop. 1929, 51,218.

**ALMOHADES**, **THE** (*al Muwahhadis*, the unitarians), were a dynasty of Moorish Emirs founded by the zealot Ibn Tumart (d. 1128). His successor, Abd el Mumin, capitalizing the religious fever awakened by Tumart, reduced Morocco by 1149 and shortly conquered all the Almoravide dominions in Spain. For a few years the capital was Seville, and the great Mosque, now altered to the Cathedral, was built. Very soon, however, the capital returned to Fez, and Spain was governed as a province, much to the weakening of Moorish power. The Emir Almansor (*Ya'qub el Mansur*) was a liberal prince; but in general the Almohades were fanatically puritanical as well as African, two counts which weighed against them with the Spanish Moors. Almansor won the last great Moorish victory in Spain; Alarcos, in 1195. His successor, Mohammed en Nasir, was defeated, in large measure through the treason of the Spanish Moors, at the Battle of Las Navas de Tolosa in 1212. With this defeat the Moors lost all Spain but the little kingdom of Granada, the latter joining the Christians against the Almohades. The last Almohade Emir, El Wathik, was murdered in 1269.

**ALMOND**, a name applied to several bushes and trees of the rose family grown for their ornamental pink, red or white double or single flowers or, in one species (*Prunus Amygdalus*), for their nuts which form an important article of commerce. The tree is said to be a native of the Mediterranean region. Some botanists believe the almond to be the progenitor of the peach, but satisfactory proof of this is lacking, although the fruit is similar in formation. Almonds of commerce are of two general groups, bitter and sweet or dessert. Bitter almonds are used for the commercial production of prussic acid and almond oil, the latter being utilized in the manufacture of confections, perfumery, cosmetics and soaps. Sweet almonds are of two classes, hard-shelled and soft-shelled. The former are of no commercial importance. Until about 50 years ago the world's supply of almonds came from the Mediterranean countries which still produce bitter almonds commercially. California then began to produce sweet almonds, especially of the so-called paper shell varieties. M. G. K.

**ALMONER**, the name given to the member of a religious community who distributed the tithes to

the poor. Kings and bishops had their almoners also. In France the office of grand almoner was of political importance, as it controlled preferments. It was first mentioned in 1462 and abolished in 1870. The British lord high almoner is usually a bishop appointed to disperse the king's bounty.

**ALOE**, a large genus of plants of the lily family, native chiefly to Africa, with a few representatives in Europe and Asia, many of which are grown for decorative purposes in mild climates and in green-houses. They are stiff, rigid perennials often of striking appearance, ranging in size from pygmy kinds only a few inches high to giant forms rising to 30 ft. The thick fleshy leaves, mostly crowded in rosettes at the base of the stem, are armed with spines along the edges and end in a sharp point. The usually leafless flower stalks bear dense clusters of tube-shaped, red or yellow blossoms. One of the best known is the true or Barbados aloe (*A. vera*), widespread in the tropics.

The intensely bitter drug called aloes, long prized in medicine, is prepared from the dried juice of several species. It is used as a cathartic and is frequently the active ingredient in purgative pills. The so-called American aloe (*century-plant*) is an agave.

**ALOPECIA**: Treatment of. See LIGHT, ARTIFICIAL, IN TREATMENT OF DISEASE.

**ALOST** or **AALST**, capital of a district in the Belgian province of East Flanders situated on the navigable Dender, also on the Brussels-Ostend railroad. It was once capital of Austrian Flanders. The chief industries are silk-weaving and lace-making. Trade in hops is carried on. Alost has a Gothic church built in 1498, a Gothic city hall with a fine tower, in front of which is a statue of Thierry Martens, who introduced printing in the Netherlands about 1474. Pop. 1930, 37,852.

**ALOXITE**, an artificial ABRASIVE made from oxide of aluminum in an electric furnace.

**ALPACA**, a long-haired, soft-footed ruminant of South America, allied to the camels. The cameloids of the New World include two wild species, the Vicuña and the Guanaco, from which latter are derived two semi-domesticated forms, the LLAMA and the alpaca, raised for their valuable wool. For centuries the Indians of Peru and Bolivia have herded alpacas like sheep on the high Andean plateaus, almost at the snow-line. It is estimated that these great flocks, with scattered herds in Ecuador and Chile, number two million head.

The alpaca, standing about 4 ft. high, is smaller than the llama, and more woolly, especially about the long upright neck and small head. The body is clothed in thick, tangled fleece, usually blackish-brown or black, but occasionally white, which in some breeds is so long as almost to sweep the ground. In shearing, some 8 in. are clipped from the total length of fleece, which is about 2 ft.

Alpaca wool is one of the choicest exports of Peru. The fiber is silky, lustrous, elastic, and strong. Peruvian Indians wove it into blankets and ponchos before

the Spanish conquest. In 1836 it was introduced into England, where its manufacture into fine cloth became an important industry. Substitutes for the genuine wool are now almost universally used in weaving so-called alpaca cloth. Attempts to acclimatize alpacas in Australia, and other parts of the world, have uniformly failed.

**ALPENA**, a city in northeastern Michigan, county seat of Alpena Co., situated on the west shore of Lake Huron, at the head of Thunder Bay, 120 mi. north of Bay City. The Thunder Bay River furnishes abundant water power for manufacturing; there are three dams across the river at Alpena. Manufactures include lumber, flour, paper, cement, leather, and wool; there is also a government fish hatchery. The total value of all manufactured products in 1929 amounted to about \$10,000,000; the retail trade reached \$5,502,133. Pop. 1920, 11,101; 1930, 12,166.

**ALPHA and OMEGA**, the first and last letters of the Greek alphabet; hence, used to signify the Deity as the beginning and end of all things (Isaiah 41:4, Revelation 1:8). In frescoes and mosaics and on altars the letters frequently appear as divine symbols.

**ALPHABET.** The history of the English alphabet, often called the Roman alphabet, is at once complicated and interesting. Except for two letters now obsolete, *ȝ* for *g*, derived from Irish script, and *þ* (pronounced *th*) from the Rune "thorn," which still survives in the archaic writing *ye* for *the*, it is descended from the Caroline minuscules (small letters) of the 9th and following centuries, and thus, through Latin and the Chalcidian form of the Western Greek alphabet, from the early Semitic scripts represented by Phoenician and the Hebrew of inscriptions and coins.

In adapting the Phoenician alphabet to the sounds of their own language, the Greeks employed the characters for *'āleph*, *hē*, *yōd*, and *'ayin* to denote the vowels *a*, *e*, *i* and *o*, and invented a sign for *u* by adapting one of the many variant forms of the Semitic *wāw*. The Semitic *hēth* (a deep guttural *h*, probably something like *ch* in German *docht* or *j* in Spanish *mujer*) became the sign for *h* in the Western Greek alphabets, but for *ē* in the Eastern Greek. The Semitic *sāmekh* (an *s* whose exact pronunciation is uncertain) survived in original form in Greek only as the sign for *gōo*, while new characters to denote *ph* (*f*), *kh* and *ps* were adopted, probably from the Carian alphabet, which had itself apparently taken them from the Semitic system. Semitic *ṭēth* (emphatic *t*) became the Greek letter for *th*; the character for short *o* was modified to indicate the corresponding long vowel; and the Old Hebrew *sāmekh* was later used to denote the compound *ks* by the letter named *xi*, this assuming two forms in East and West Greek respectively, of which the second survived in the Latin alphabet as *x*. The remaining Semitic characters were carried over into Greek with values changed little, if at all.

As already implied, the Greek alphabet fell into two broad divisions: Eastern Greek, used in the Aegean area, the cities of Asia Minor, and, with lesser variations, in Attica, Aegina and the northern Pelopon-

nesus; and Western Greek, in the most of Greece Proper and its colonies. From these colonies in Italy, especially Cumae, founded by immigrants from Chalcis in Euboea, who had carried their local script with them, the Latin alphabet was derived.

This Italo-Greek alphabet possessed characters for the following: *a*, *b*, *g* (*c*), *d*, *e*, *w* (*f*), *z*, *h*, *th*, *i*, *k*, *l*, *m*, *n*, *o*, *p*, *q*, *r*, *s*, *t*, *u*, *x* (*ks*), *ph*, *kh*. The aspirated surds (pronounced as in *boat-hook*, *top-hat*, *ink-horn*), having no equivalent sounds in Latin, were not employed as letters in the Latin alphabet, though they

	CAROLINE MINUSCULE	EARLY ROMAN UNCIAL	LATIN	CHALCIDIAN GREEK	GREEK VALUES	PHOENICIAN	INSCRIPTIONAL HEBREW	SEMITIC VALUES
A a	a	Α	Α Α Α	Α Α Α	α	Ⲁ	Ⲁ	א
B b	b	Β	Β Β	Β Β	β	Ⲃ	Ⲃ	ב
C c	c	Γ						
D d	d	Δ	Δ Δ	Δ Δ Δ	δ	Ⲅ	Ⲅ	ד
E e	e	Ε	Ε	Ε Ε	ε	Ⲇ	Ⲇ	ה
F f	f	Ϝ	Ϝ	Ϝ	Ϝ	Ⲉ	Ⲉ	ו, u
G g	g	Ζ	Ζ Ζ	Ζ Ζ Ζ	γ	Ⲋ	Ⲋ	ג
H h	h	Η	Η	Η Η	η	Ⲍ	Ⲍ	ח
I i	i	Θ	Θ	Θ	ι	Ⲏ	Ⲏ	י, e
J j								
K k			Κ	Κ	κ	Ⲑ	Ⲑ	כ
L l	l	Λ	Λ Λ	Λ	λ	Ⲓ	Ⲓ	ל
M m	m	Μ	Μ	Μ Μ	μ	Ⲕ	Ⲕ	מ
N n	n	Ν	Ν Ν	Ν Ν	ν	Ⲗ	Ⲗ	נ
O o	o	Ο	Ο	Ο	ο	Ⲙ	Ⲙ	ע
P p	p	Π	Π Π	Π Π	π	Ⲛ	Ⲛ	פ
Q q	q	Ϟ	Ϟ Ϟ	Ϟ	Ϟ	Ⲝ	Ⲝ	ק
R r	r	Ρ	Ρ Ρ Ρ	Ρ Ρ Ρ	ρ	Ⲟ	Ⲟ	ר
S s	f	Σ	Σ Σ	Σ Σ Σ	σ	Ⲡ	Ⲡ	ש
T t	t	Τ	Τ	Τ	τ	Ⲣ	Ⲣ	ט
U u	u	Υ	Υ Υ	Υ Υ	υ, υ̇	Ⲥ	Ⲥ	ו, u
V v		Ϝ	Ϝ Ϝ	Ϝ Ϝ	υ, υ̇	ⲧ	ⲧ	ו, u
W w								
X x	x	Χ	Χ	Χ Χ	χ	ⲩ	ⲩ	ש
Y y				Υ Υ	υ, υ̇	ⲫ	ⲫ	ו, u
Z z	z			Ζ Ζ	ζ	ⲫ	ⲫ	ז

THE DERIVATION OF THE ENGLISH ALPHABET

survived, in mutilated form, as the numerical signs C, CIO, and L for 100, 1000 and 50 respectively. (V = 5 is a conventionalized pictograph of the spread fingers of one hand with only the thumb and little finger actually represented; and X = 10 symbolizes the two hands united at the wrist.) At first, *c* and *g* were not differentiated (e.g. Old Latin ECO = *ego*), but later *c* was specialized to replace *k*, which survived only in a few archaic words, as *kalendae*, while *c* retained its old value solely in the abbreviations C and CN for the proper names Gaius and Gnaeus. A modification of C (*G*) usurped in alphabetic order the old



1, 4, 5, COURTESY COLUMBIA UNIVERSITY LIBRARY; 2, 3, METROPOLITAN MUSEUM OF ART

# THE WRITTEN CHARACTERS OF ANCIENT PEOPLES

1. Hittite tablet from Marash, Anatolia.
2. Egyptian hieroglyphics on the funerary papyrus of Princess Entiu-Ny, daughter of King Pay-Nudjem (about 1025 B.C.); she is shown plowing and cutting grain.
3. Mummy labels in Demotic Egyptian.
4. Japanese script from the *Shin Kin Shun*, an anthology of ancient and modern aristocratic verse, probably of the 15th century.
5. Page of a Chinese translation from the Buddhist *Saddharmapundarika-sutra*.
6. Cuneiform tablet, the stele of Silhak at Susa.



z (soft s), which was not found in Latin, though it was later reintroduced and placed at the end of the alphabet to transcribe Greek words borrowed from Latin. The Greek "digamma," with the earlier value *w*, was made to represent *f*; *q* survived only before *u* (*quis*, Old Latin QURA = *cura*); *y* was introduced in Cicero's time to transcribe the Greek "upsilon," whose value was that of French *u* or German *ü*, *y*, *v*, and *u* all being variant forms of this same Greek letter. Only *j* and *w* were now lacking to complete the English alphabet.

Wherever Roman civilization spread, the Latin alphabet was carried. Thus it passed into Gaul, whence, about 450, St. Patrick introduced it into Ireland. Irish missionaries to Britain took it to Northumbria, and thence, when Alcuin of York was summoned by Charlemagne to establish a center of learning at Tours, it returned to France, to go again to Britain with the Normans. Meanwhile, various regional systems had developed from Latin script: Lombardic in Italy, Visigothic in Spain, and Merovingian in the Frankish Empire. From the latter, aided by the influence of Alcuin and his school, the Caroline script arose, and gradually dominated all the others. Here, as had already been the case in Latin, Greek and Egyptian, we find two broad categories: capitals (or majuscules, modified and rounded in Latin into uncials) and small letters (minuscules, semi-uncials), the latter being primarily cursives (running hand). As a written script, the Caroline minuscules, with capitals redeveloped, evolved in England into the Court and the Chancery Hands, the former, long discarded, cramped, and the latter angular, as is still seen in documents formally engrossed; and modified by the national script, itself an Anglo-Saxon adaptation of the Latin alphabet, it likewise survives in the Old English printer's type.

During the Middle Ages, *i* and *j* were differentiated, the latter being used to denote the consonantal value of the semi-vowel with the sound of English *y*, and being employed also at the end of words, as is still frequently the case in Italian (e.g. *studj* beside *studi*). A like distinction was made between *u* and *v* (cf. inscriptional Latin SERVVS = cursive *seruus* = *servus*); and to represent the Teutonic labial spirant, not found in Latin, two *v*'s were combined into the character called "double *u*" (i.e. *w*).

By the end of the 12th century, the Caroline minuscules had reached the acme of their development. In this form they passed to Italy, while in France they became more angular and were adorned with cross-bars, until, in the 15th century, this script was imitated in the earliest movable types. Thus it was perpetuated, especially in Germany and England, by the Gothic or Black Letter, still much used in Germany and employed in the earliest English printed books. In Italy, on the other hand, it was discarded in favor of the older and more perfect Caroline form of the 11th century. This type was carried to France, and thence to England, where it was first used by Henry VIII in 1521 in his "Declaration of the Seven Sacraments,"

probably because of the Italian nationality of Pope Leo X. These Roman letters became the standard in England, and have now superseded the Gothic form almost universally. A variant, of more sloping type, devised by the famous Venetian printer and scholar Aldus Manutius, has given rise to the script known as *italic*. L. H. G.

**ALPHA CENTAURI**, the third brightest star in the sky and one of the first three stars for which, in 1838, the distance was directly determined. With its companion PROXIMA CENTAURI it constitutes the star system nearest to us, being only  $4\frac{1}{2}$  light years away. Alpha Centauri is a double star, the brighter component of which is an almost exact duplicate of our sun, while the other star is smaller, lighter, cooler and fainter, and revolves around the primary in 79 years at an average distance of 2,000 million miles. See STAR: *map*.

**ALPHA CRUCIS**, the brightest star of the Southern Cross, a typical, very hot, blue star of the first magnitude. Its distance is probably 230 light years, and it surpasses the sun 1,600 times in brightness. See STAR: *map*.

**ALPHA PARTICLES**, electrically charged bits of matter spontaneously ejected from certain of the radioactive elements (see RADIOACTIVITY). They are too small to be seen, even with a microscope, but may be studied by means of the IONS, or electrical particles, which they create on passing through a gas. They may also be studied by the scintillations, or flashes of light, which they produce when they strike a fluorescent screen (see FLUORESCENCE). Further, they produce blackening when they strike a photographic plate.

The mass of the alpha particle is four times that of the hydrogen ATOM. Its electrical charge is exactly twice that of the ELECTRON, but it is of opposite sign, being positive rather than negative. From this and other evidence, it is known that an alpha particle is the nucleus of the HELIUM atom.

A stream of alpha particles ejected by a radioactive substance is called an *alpha ray*. The particles have a high velocity, about one-tenth that of light, or roughly  $3 \times 10^9$  cm. per sec. They travel in straight lines through the air for a distance ranging between 2.4 and 8.2 cm. according to the active material from which they have their source. This range is a constant for any one given substance, differing for different substances. See also BETA RAYS; GAMMA RAYS. J. B. H.

**ALPHEUS (RUPHIA)**, the most important river of the Peloponnesus, named in honor of the river god of southern Greece, as Achelous was in northern Greece. The source of the river is near Asea in Arcadia. Just above Olympia it is joined by the Erymanthus and the Ladon, and flows into the Ionian Sea. The legend was that the river God, Alpheus, pursued the nymph, ARETHUSA, beneath the sea to Syracuse where she came up as a fountain. It was navigable 6 mi. from its mouth, according to Pliny.

**ALPHONSO**, the name of a number of Spanish kings. Aragon and Navarre: Alphonso I (reigned

1105-34) won 29 battles, reconquered extensive territory from the Moors, and was fatally wounded in his last engagement. Alphonso II (1162-96) protected the rights of the people, aided the troubadours and conquered adjoining territory. Alphonso III (1285-91) granted privileges to his people and warred against France, Naples and the Pope. Alphonso IV (1327-36) quarreled with Parliament about his wife's extravagance. Alphonso V (1416-58) came to the aid of Joanna of Naples, who turned against him. He continued the fight until the death of the queen gave him possession of her kingdom. Leon and Castile: Alphonso VI (1072-1109) succeeded to Castile, Galicia and Leon, divided Navarre with Aragon, conquered Toledo, and fell in battle the following year. Alphonso VII (1126-57) ceded part of Navarre to Aragon, called himself Emperor of Spain although under him Portugal became independent. Alphonso VIII (1158-1214) won the battle of Las Navas de Tolosa which destroyed the Moorish power in Spain. Alphonso IX (1188-1230), of Leon, married the daughter of Alphonso VIII, founding the final union of Castile and Leon. ALPHONSO X (1252-82), by his plans for the succession, aroused civil war and was dethroned 1282. He greatly encouraged the arts and sciences, particularly astronomy. Alphonso XI (1312-50) ascended the throne at 15 and restored with arms the royal prestige and peace. He won decisive victories over the Moors and died during the siege of Gibraltar. ALPHONSO XII (1874-85); ALPHONSO XIII (1902-31).

**ALPHONSO X** (1252-84), the Wise, King of Leon and Castile, succeeded his father Ferdinand III in 1252. He conquered the parts of the Guadalquivir Valley still in hands of the Moors and annexed to Castile the kingdom of Murcia newly won from the Moors by Aragon. His fame rests chiefly on his literary and scientific work, both his own, the *Fuero Real*, and his collections of vernacular Spanish writings. Under his guidance were prepared, mostly by Arab and Jewish scientists, the *Alfonsine Tables*, the great summation of Ptolemaic astronomy. Following his election to the Empire in 1254 during the Great Interregnum, although he never entered Germany, he undertook grandiose and expensive schemes against his rival Richard of Cornwall. His dissatisfied nobles refused to follow him in barring from the throne his second son Sancho, his eldest son having died, and deposed him in 1282. The great collection of Spanish law, the *Siete Partidas* with which his name is connected, was begun by him but actually issued by his great-grandson. He died at Seville in 1284.

**ALPHONSO XII** (1857-85), King of Spain, was born at Madrid Nov. 28, 1857. Forced to leave Spain when his mother, Queen Isabella II, was deposed in the revolution of 1868, he was educated in Paris and Vienna. In 1870 his mother abdicated in his favor, but the Spanish people refused to accept him. Finally after four years he was in 1874 proclaimed king of all Spain. He died Nov. 24, 1885, and was succeeded by Alphonso XIII, his posthumous son.

**ALPHONSO XIII** (1886- ), King of Spain, was born in Madrid, May 17, 1886, the posthumous son of Alphonso XII. At his birth he was proclaimed sovereign under the regency of his mother, Maria Christina, Archduchess of Austria. He assumed personal charge of the government in his sixteenth year. On May 31, 1906, Alphonso married VICTORIA EUGENIE of Battenberg, the granddaughter of Queen Victoria. The royal pair narrowly escaped assassination by anarchists on their wedding day. Several other attempts on King Alphonso's life have been made. As a man Alphonso has been popular but as a king greatly criticized. His support of the dictatorship of Rivera led to his overthrow in 1931 when Spain proclaimed itself a republic. After his flight from Madrid Alphonso lived in France.

**ALPINE CLUBS.** See **HIKING**.

**ALPINE PLANTS**, the vegetation of high mountains found above the upper limit of trees (timberline). The extremely adverse climatic conditions result in characteristic adaptations in structure and growth. These are exemplified in numerous dwarfed, gnarled and twisted shrubs and in many creeping plants, which form matted tufts and carpet-like patches. The cushion form of growth, seen elsewhere in mosses, is especially common, as is also the rosette. While the stems and leaves are mostly very small, the roots are unusually large, as are the flowers, which are often brilliantly colored and hence attract the scant insect life. Characteristic flowering plants of the alpine zone are saxifrages, primroses, gentians, sandworts and heaths. Intermingled with these are various small ferns, mosses, lichens and algæ. Many alpine plants make attractive additions to rock gardens.

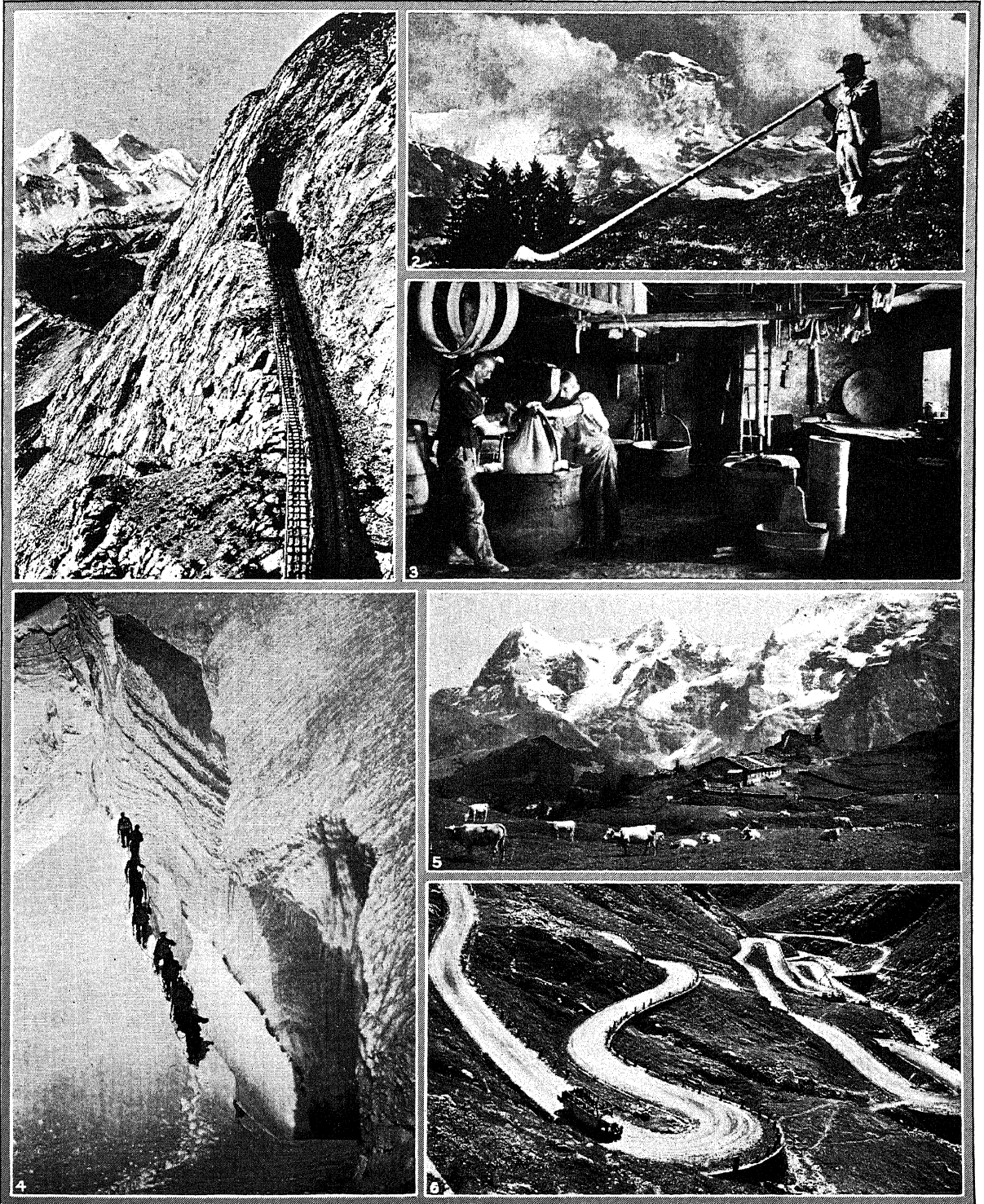
**ALPS**, group name for the highest mountains of Europe, connecting the Apennines and Carpathians. The range is a sweeping curve, 750 mi. long, which stretches from Genoa northward along the boundary between France and Italy and eastward through Switzerland and Austria as far as Vienna. It begins as a single chain about 30 mi. wide but on its eastward course is divided by river valleys into two, then three, and then five major ranges which spread to a width of 200 mi. As the mountain mass widens it loses height, and the steep, ice-carved peaks of the Western and Central Alps give way in the eastern section to softer outlines and gentler slopes which have no glaciers or permanent snow. Highlands known as forealps border the main ranges.

Throughout their extent the Alps are remarkable for the varied splendor of their scenery. Particularly well-favored are the south-facing slopes where the rich deep colorings of vineyards and orchards contrast sharply with the white, cloud-hung summits. Between the timberline and snowfields are the open "alps" or meadows which provide grazing pastures for sheep, goats and dairy cattle.

A considerable portion of the crestline of the Alps rises above 10,000 ft. where an Arctic climate prevails and a snow-pack of great depth has accumulated.



# ALPS



COURTESY SWISS FEDERAL RAILWAY

## AMONG THE RUGGED SWISS ALPS

1. The Eselwand section of the cog railroad ascending Mt. Pilatus, on Lake Lucerne. 2. Horn blower in the Bernese Oberland. 3. Cheese making in a communal hut. Simmen valley, Bernese Oberland. 4. Alpinists traversing a perilous

glacier region in the Swiss Alps. 5. Characteristic pastoral scene near Mürren. Beyond rise the famous Alpine trio, Eiger, Mönch and the Jungfrau. 6. A motor bus on the St. Gotthard pass which connects Andermatt with Airolo.



This reservoir is the source of hundreds of glaciers which feed the great drainage systems of the Rhone, Rhine, Danube and Po.

Along either margin of the mountains where the valleys meet the plain, the rivers expand into long, narrow lakes. On the north are Geneva, Lucerne, Zug, Thun and Constance, and on the south Lugano, Maggiore, Como and Garda. The valleys afford easy means of east and west travel but communication from north to south is possible only by mountain passes. The celebrated St. Bernard connecting Martigny and Aosta lies between permanent snowfields and is open only in summer. Mont Cenis connecting France and Italy, and the St. Gotthard and Simplon passes connecting northern Switzerland and Italy, have been tunneled for railroads. Brenner pass in the Austrian Tyrol is only 4,500 ft. high and a railroad passes over it.

**Divisions.** As a whole, the Alps have three main divisions, each subdivided into ranges. The Western Alps, which extend from the Riviera on the Gulf of Genoa northward to the St. Bernard pass, are made up of the Maritime, Cottian, Dauphine and Graian groups, and the Mont Blanc range culminating in MONT BLANC, 15,781 ft. in elevation, the highest peak in the Alps. Of particular interest in this section are the Pic des Ecrins, 13,462 ft. high, La Meije, 13,081 ft., and the Romanche valley in the Dauphine range; the Grand Paradis, 13,320 ft., in the Graian group and Mont Viso, 12,605 ft., in the Cottian Alps.

The Central Alps which lie between St. Bernard pass and the TYROL region, are divided into four parts by as many rivers rising around the St. Gotthard mountains. Between the Rhone and Reuss and surrounding the Lauterbrunnen valley is the Bernese Oberland, a compact mass of rugged peaks including the Jungfrau, 14,671 ft.; Finsteraarhorn, 14,026 ft.; Monch, 13,438 ft., and Aletschhorn, 13,803 ft. Between the Rhone and Ticino rivers are the Lepontine and Pennine Alps. The latter surround the Zermatt valley above which rise such superb peaks as MONT ROSA, 15,217 ft., the Mischabelhorn, 14,935 ft., the WEISSHORN, 14,804 ft., and the MATTERHORN, 14,780 ft. Between the Reuss and the Rhine rivers are the Glarus group, the Tödi range and the Sentis or North Swiss Alps. Between the Rhine and Ticino are the Rhaetian Alps made up of the Albula group and the Rhatikon-Silvretta chain on the north and the Bernina range on the south. Between them is the Engadine valley containing St. Moritz. The forealps between Lake Maggiore and the Adige valley are known as the Lombard chain and include the Bergamasque Alps.

The Eastern Alps lie chiefly in Austria and northern Italy. North of the long valley containing the upper courses of the Inn, Salzach and Enns rivers are the Noric Alps bordered on the north by the Bavarian, Salzburg and Austrian forealps. South of this valley are the ranges of the Central Tirol including the Tauern, Ortler, Stubai and Oetzthaler groups. Farther east, on either side of the Mur River are the Semmering and Styrian Alps. South of the Drave

River are the Carnic Alps which are divided toward the east by the upper Save River into the Karawanken and Julian ranges. In northern Italy the region of the South Tirol contains the DOLOMITES bordered by the Venetian forealps which extend from the valley of the Adige nearly to Trieste.

An entirely separate, outlying chain is the JURA range in northern Switzerland.

**ALSACE**, a province of France, is bounded by the Rhine River on the east and the Vosges Mts. on the west and extends from near Basel, Switzerland, on the south to Wissembourg on the north. It was colonized by Alemannic tribes in the 5th and 6th centuries and subsequently formed part of Lothair's kingdom by the TREATY OF VERDUN, 843. From 870 to 1648 it owed allegiance to the German emperors as part of the Duchy of Swabia. During this period considerable independence was enjoyed, the 10 imperial cities being "free" and the rest of the territory being governed in large part by bishops of Strasbourg and Basel. France obtained most of Alsace at the conclusion of the THIRTY YEARS' WAR, by the TREATY OF WESTPHALIA, 1648, and the remainder, Strasbourg and certain of the imperial estates, by the Chambers of Reunion, 1680-83, whose acts were recognized by the Empire in 1697. Alsace was the scene of stirring events during the FRENCH REVOLUTION, the *Marseillaise* being composed in Strasbourg. See also ALSACE-LORRAINE.

**ALSACE-LORRAINE**, a term which did not come into use until the FRANCO-GERMAN WAR, 1870, when victorious Germany annexed ALSACE and part of the Old Duchy of LORRAINE. The inhabitants of Alsace-Lorraine were generally opposed to their separation from France, 1871, their elected representatives to the French Assembly voting unanimously against the change and members of some of the leading families migrating to France. Despite the fact that about 87% of the natives of these provinces spoke German, Germany met several obstacles in her administration of them. At first she attempted a virtual dictatorship which called forth a campaign for local autonomy and demands for the rights of citizens. Gradually the feelings of the natives were appeased, however, a modified form of representative government being established in 1874 and a Landtag, that could make laws with the consent of the Emperor, being set up in 1911.

During the WORLD WAR the Alsace-Lorrainers fought fairly loyally for Germany, although some deserted to France. The rigors of war made German rule oppressive, however, and the French were received enthusiastically in 1918. In spite of this warm reception the way of the French in Alsace-Lorraine since the war has not been an easy one. France aroused the hostility of the strong religious groups by threatening to introduce her anti-clerical legislation; she antagonized the working classes by planning to abridge the social insurance system; she awoke, in spite of her successful attempts to improve the general economic status of the provinces, the opposition

of those who had their fortunes in francs by her policy of inflation; and she received the enmity of those who loved German culture by using the French language and stressing French culture in the schools. The general discontent found expression in politics, the autonomist *Hermutbund* being formed in 1926, important anti-French groups appearing in the Catholic Party, a Liberal Autonomist Party being created, and the Communist Party taking a definite stand against France. In the elections to the General Councils of the departments in 1928, 34 of the 51 representatives elected were of regionalist sympathies. Pop. 1931, 1,898,376. S. B. C.

**ALTADENA**, a residential suburb adjoining Pasadena on the north, situated in Los Angeles Co., southern California, and on the Pacific Electric Railway. It is unincorporated and is under the Pasadena public school system. Altadena lies on a mesa at the foot of the Sierra Madre range. In the vicinity are Mt. Lowe and Mt. Wilson, the latter the site of Mt. Wilson Solar Observatory, with the Carnegie 100-in. telescope. Pop. 1920, 12,000; 1930, 17,957.

**ALTAI**, a mountainous region covering the southern parts of Tomsk, Siberia, and partly extending into Mongolia. From the Irtish valley the Altai, or Golden Mountains of the Chinese, stretch mainly northeastwards through the Sayan range to the Daurian Alps, and thence beyond the Baikal basin, under diverse names, to the volcanic masses filling the greater part of Kamchatka, and gradually falling through the Chukchi domain towards the northeastern extremity of the continent at East Cape. The system is by no means continuous, being not only broken up into distinct sections by the deep gorges of the Yenisei and Selenga rivers, but merging round the Sea of Okhotsk in a moderately elevated plateau. The Altai proper, the western section, is not so much a distinct mountain range as an aggregate of more or less detached chains running in various directions between the upper Irtish and Yenisei valleys. At Lake Altyn the Altai is crossed by the Suok Pass leading from Siberia to Mongolia. East of the pass the system is continued by the Sayan range with no perceptible interruption to the Upper Yenisei valley. The whole range has a mean altitude of about 5,000 ft., with numerous crests from 6,000 to 10,000 ft., culminating in the Bieluka, or White Mountain, whose twin peaks rise to 11,100 ft.

The western section of the Altai abounds in ores, and encloses the romantic little Lake Kolyman, whose granite banks are here and there clothed with fine timber. Elsewhere the numerous and rapid streams, the varied forms and colors of the hills, impart great variety to the scenery. The southern spurs consist largely of granites with crystalline schists, presenting fantastic, bare and rugged outlines. Here lies the famous mining region of the Altai.

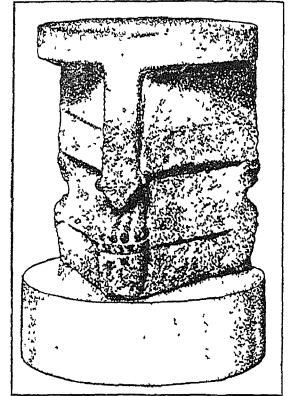
**ALTAIR** (*Alpha Aquilae*), a star of the first magnitude and the brightest star of the constellation *AQUILA*, the Eagle. The name is a corruption of the Arabic *El-Nasr-el-Tair*, signifying the flying eagle.

Altair is among the nearer stars, being only 16 light years distant, white in color, and 9 times brighter than the sun. See *STAR: map*.

**ALTAITE**, a tin-white to yellowish metallic mineral consisting of lead and tellurium, crystallizing in the *ISOMETRIC SYSTEM*. It is found with the gold and silver telluride ores. See also *ORE DEPOSITS*; *TELLURIDE*.

**ALTAR**, any artificial elevation built for the purpose of offering sacrifices. In very early times altars were roughly made of earth, stone or wood. Among the Greeks and Romans they were works of art in stone and erected not only in temples, but on streets and squares, in groves, at springs and other places. The Jews

for a long time clung to their old custom of building altars on hills, until Solomon's Temple became the only place of worship where sacrifices were permitted. The Roman Catholic Church transformed the communion table into an altar to symbolize Christ's sacrifice. In the oldest Christian churches the altar stood just beyond the apse, later farther back, and always toward the east. Besides the high altar in the choir, side altars were added for private masses. The Romanesque period retained the shape of a table in use since the 6th century, frequently with a baldachin (see *CIBORIUM*) above it.



ASSYRIAN ALTAR, 885-860 B.C.



ANCIENT GREEK ALTAR, WITH APOLLO AND ARTEMIS STANDING BEFORE IT

In the early Gothic era the altars were of wood, richly carved, painted and gilded. A characteristic form is the triptych or *SHRINE*. The Renaissance borrowed antique architectural forms and the Baroque art developed and embellished them even more lavishly, so that not only the high altars, but even the side altars became independent works of art. The large painting behind altars originated in the Renaissance. Back of the altar stand crucifix and candlesticks and the front is draped with rich silks and

brocades according to the LITURGICAL COLORS. The Greek Church uses an altar either of stone or of wood and, as a rule, has but one altar in each church.

**ALTAR OF REPOSE** or **REPOSITORY**, a side altar, where the Host consecrated on Maundy Thursday is reserved for the Mass of the Presanctified on Good Friday. After the Thursday Mass the Host, placed in a small receptacle and covered with a white veil, is conveyed in procession to a side altar or an adjoining chapel and deposited there, surrounded by flowers and lighted candles. It remains there until it is put in a repository after the Adoration of the Cross to the main altar for the Mass of the Presanctified.

**ALTENBURG**, a city in the German state THURINGIA, located about 23 mi. south of Leipzig. Until 1918, it was the capital of the Duchy of Saxe-Altenburg. It lies around a castle built in the 11th and 12th centuries. Altenburg has a Renaissance rathaus, 1562-64, and a former abbey church, whose towers are united by a bridge. Its industries are diversified; it trades in lumber, grain, cattle, leather, groceries and seeds. Pop. 1925, 42,570.

**ALTERNATING CURRENT**, an electric current which flows in a conductor or around a circuit alternately in opposite directions. The FREQUENCY of an alternating current is the number of double alternations, or the number of times the current flows in the same direction, in one second. For example, a current having a frequency of 60, called a 60-cycle current, makes 120 alternations, or changes in direction, per second. This frequency is the one most widely used in commercial circuits for both power and lighting purposes. Lower frequencies, notably 25-cycles, are sometimes used for power circuits but seldom for lighting because they produce a noticeable flicker in the lamps.

In commercial fields, alternating current has largely displaced direct current, which flows continuously in one direction, except in certain fields to which the alternating current is not adapted; e.g., in the electrolytic refining of metals and in electroplating (see ELECTROLYSIS). The principal reason for this is the ease and efficiency with which alternating currents may be changed in voltage and transmitted over long distances. A given amount of power in the form of large alternating current at low voltage may be changed to small current at high voltage and sent over transmission lines to great distances with comparatively small loss of power in the transmitting wires; if transmitted in its original form, the line losses would be prohibitive. The reason is that the power loss in any line is proportional to the current squared. The change in voltage and current is effected by means of a step-up TRANSFORMER. At the receiving end of the transmission line a step-down transformer is used to change the transmitted power to the form of larger current and lower voltage. L. B. S.

**ALTERNATION, VOCALIC** (or **APOPHONY, ABLAUT**), modification of the vowel of the base particularly through the effect of stress-accent. In

INDO-EUROPEAN there are two series of alternations according to whether the vowel or diphthong of the normal grade of the base is short or long, the former being the more usual type. The short series has four grades: normal, prolonged, sub-short and zero (e.g., *e, ē, ī, o*); and the long series also four: normal, short, reduced and zero (e.g., *ē, e, ə, o*). In the case of diphthongs, the semi-vowel either remains or becomes vocalic as follows: short series, *ei, ēi, ūi = ī, i*; long series *ēi, ei, əi = ī, i*. The normal grade bears the accent; the prolonged grade seems to arise in an accented syllable as compensation for the loss of a vowel from the syllable immediately following; the sub-short is reduced in the syllable immediately preceding or following the accent; and the zero in the syllable not immediately preceding, or following. But the exact conditions for sub-shortening or reduction and complete disappearance are not wholly determined.

Besides this "quantitative" alternation, there is also a "qualitative" form, perhaps due to musical ACCENT, in which *e* alternates with *o*, the former apparently originally under heightened (acute) intonation, and the latter not so intoned.

Alternation is a highly important phenomenon in linguistics generally, and in GERMANIC has become a mark of inflection, especially in the "strong," or "irregular," verbs like the English *begin, began, begun*.

L. H. G.

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**ALTERNATION OF GENERATIONS**, in biology, a phrase expressive of the fact that during the life cycle in a number of groups of animals, and in plants quite characteristically, two periods of growth and development exist. Usually a period of asexual reproduction alternates with one of sexual reproduction, and in plants this is almost universally the case. To this the term metagenesis is applied.

Among the lowest single-celled animals and plants (*Protista*), multiplication by division (fission or budding) is prevalent but it appears normally to be interrupted at intervals by a conjugation of individuals which essentially is like sexual reproduction (see REPRODUCTION, SEX). The phases are usually too ill-defined to constitute a definite alternation of generations and it is only in the higher and colonial protozoa that examples of metagenesis are encountered, e.g., *Volvox*.

Among the metazoa (many-celled animals) instances of a precise metagenesis occur in coelenterates (*Hydrozoa*), sponges, flat worms, polyzoa, segmented worms (*Autolytus*) and ascidians (*Salpa*). No instances occur in vertebrate animals.

Among the metazoa the asexual phase is usually a form of budding alternating with true sexual reproduction, i.e., formation of male and female reproductive cells, fertilization of the egg and a period of development. The full life history is frequently complicated and sometimes in the two phases the animals

appear so different (*see* POLYMORPHISM) that not infrequently they were at first thought to be different species.

In addition to metagenesis there are encountered, but more rarely, two other forms of alternation of generations. 1. An alternation of sexual reproduction and a period of multiplication by parthenogenesis; that is, the development of true eggs without fertilization, only females being produced. This is best illustrated among the plant lice (Aphids). During the favorable conditions of spring and summer parthenogenesis prevails; under the unfavorable conditions of autumn males and females are produced and the fertilized eggs as winter eggs remain dormant until spring, a process known as heterogamy. 2. Rarely, e.g., the round worm, *Ascaris nigrovenosa*, a hermaphrodite generation alternates with one where separate males and females exist (heterogeny).

In plants metagenesis is the rule, the two phases of the life cycle being known as the sporophyte (asexual, reproducing by spores) and the gametophyte (sexual, reproducing through the fusion of gametes).

B. F. K.

**ALTHAEA**, daughter of Thestius, king of Aetolia, and wife of Oeneus; chiefly famous as the mother of the hero Meleager.

**ALTIMETER**, an ANEROID BAROMETER used on aircraft graduated to read in the altitude equivalents of atmospheric pressure. It shows height above sea-level or, if a rotatable dial has been set to zero at the place of departure, the height above that place.

**ALTITUDE**, the arc or angle between a heavenly body and the horizon measured perpendicularly to the horizon along the great circle through the object and the zenith.

**ALTMAN, BENJAMIN** (1840-1913), New York merchant, was born in New York City July 12, 1840, of immigrant Jewish parents. His schooling was neglected to help his father in their small store. Working in other retail stores around New York supplied experience and capital to open his own business in 1865. Five years later he moved to Sixth Ave. and 19th St., where, by astute merchandising methods, he acquired a leading place among New York retailers. Foreseeing the uptown trend of business, he moved in 1906 to Fifth Ave. and 34th St., where his firm ultimately occupied the entire block. He died at New York, Oct. 7, 1913.

**ALTO**, the lowest female voice having the normal compass from f to d, was originally the highest male voice (from *altus*, high), being placed above the tenor which sang the CANTO FERMO. Although contralto, or *contra alto*, was originally a lower voice singing against the alto, the two terms are now interchangeable. The alto clef is no longer used in vocal music but is frequently encountered in orchestral music. It is the C CLEF placed on the third line of the staff.

**ALTON**, an industrial city of Madison Co., Ill., on the Mississippi River, 25 mi. north of St. Louis,

Mo., and about 5 mi. south of the mouth of the Missouri River. Abundant railroad facilities include the Illinois Terminal freight connections with all lines serving East St. Louis. A railroad bridge spans the Mississippi at Alton and there are steamboat connections and a considerable river trade. The city ships farm produce and has extensive industrial interests promoted by its accessibility, an ample water supply, coal resources and quarries of building-stone. Bottle works, flour mills, foundries and large oil refineries in the vicinity are outstanding industrial establishments. In 1929 the value of the manufactures was about \$20,000,000; the retail trade amounted to \$15,203,113. Among its educational institutions are Shurtleff College and Western Military Academy. The residential section is attractively situated on limestone bluffs more than 200 ft. high. Of historical interest are a monument to Elijah Lovejoy, killed in an anti-abolitionist riot in 1837, his printing press and a monument commemorating the Lincoln-Douglas debate in Alton. The town was founded in 1817 and became a city in 1837. Pop. 1920, 24,682; 1930, 30,151.

**ALTONA**, city in the Prussian province of Schleswig-Holstein on the Elbe River, adjacent to Hamburg. It has wide, regular streets, some with rows of fine trees, handsome squares and parks overlooking the river and the country beyond. The buildings are modern, as are the many monuments and fountains. It has a large iron and metal goods industry with a great many factories manufacturing diversified products. Aided by the Elbe, Altona has a very heavy trade, principally in grain, food products, coal and oil, shipping to all parts of the world. An insignificant fishing village in the 15th century, it was an asylum for persecuted Catholics, Protestants and Jews and grew rapidly. The city fell to Prussia in 1866 and a free harbor was established in 1901. Altona is now the second largest fishing port in Germany. Pop. 1925, 185,653.

**ALTOONA**, a city of central Pennsylvania in Blair Co., in the picturesque mountainous and Logan Valley district, 1,180 ft. above sea level. It is about 114 mi. east of Pittsburgh and is served by the Pennsylvania Railroad, bus lines and two airports nearby. The Pennsylvania Railroad in fact created the town in 1849 as a base for its construction operations. Railroad car and locomotive construction shops, among the largest in the world, freight classification yard and foundries of the Pennsylvania Railroad comprise the chief industry. This section contains the state's most beautiful scenery, the famous Horseshoe Curve being 4 mi. to the west. It is the center of bituminous coal fields and also part of an agricultural district, whose products are valued at \$5,000,000 annually. Manufactured products, which besides the railroad units include silk, paper products, printing supplies, bricks, motor trucks and others, in 1929 were valued at approximately \$72,000,000. The same year the retail trade amounted to \$39,353,224.

Altoona was incorporated as a borough in 1858 and became a city in 1868. An Indian massacre took place



here in 1781. Here is the site of Ft. Roberdeau, where lead was mined for bullets during the Revolution. Altoona was the meeting-place of the loyal war governors of the North, who in 1862 pledged support to Lincoln. Andrew Carnegie once lived in Altoona. Pop. 1920, 60,331; 1930, 82,054; about 8% were foreign-born.

**ALTRUISM**, an ethical doctrine which holds conduct to be properly motivated only when it takes the welfare of others into consideration. Logically it should have reference to others regardless of good or bad intentions, but practically the word is associated with the good of others. The term gets its meaning in opposition to egoism, which considers only the welfare of self.

The conflict between egoism and altruism is an old one and received much attention from thinkers in the middle of the 19th century. It is a debatable question whether any purely egoistic or purely altruistic motives exist. HERBERT SPENCER recognized mixed feelings. Because of the sterility of this discussion the tendency at the present time is to ignore the issue by approaching the problem from another standpoint, that of the nature of the interest under consideration. This psychology has the advantage of identifying self with its object, whereas the old approach divorced them.

**ALTUS**, a city in southwestern Oklahoma, the county seat of Jackson Co., situated not far from the Red River, and 169 mi. southwest of Oklahoma City. Bus and truck lines and three railroads afford transportation. There is a municipal landing field. The region produces chiefly cotton. Cotton seed products and flour are the principal manufactures. Lake Altus, near by, is an artificial lake constructed by damming a tributary of the Red River at the expense of the city: this lake has an abundant water supply. Altus was founded in 1892; incorporated in 1909. Pop. 1920, 4,522; 1930, 8,439.

**ALTYN TAGH**, a mountain chain of central Asia, lying in the Chinese region of Sin-Kiang, south of the Tarim basin. The chain comprises the northern bulwark of the Kunlun Mountain system. Its extent is within 38° and 39° N. lat. and between 85° and 95° E. long. The highest peaks rise 14,000 ft.

**ALUM**, common name for potassium aluminum sulphate,  $\text{AlK}(\text{SO}_4)_2 + 12\text{H}_2\text{O}$ , occurs as a white crystalline powder. It is an astringent and is seldom administered internally. Among the public it had a wide use at one time for the treatment of canker sores, but this has been largely superseded by more efficient drugs. The dehydrated form is known as exsiccated alum or burnt alum, which is sometimes used by physicians as a dusting powder. In ammonia alum, the ammonium replaces the potassium. The term *alum* is also applied to double sulphates of alum type, such as chrome alum. It is also used to designate a member of double aluminum compounds, as sodium aluminum sulphate or sodium or potassium aluminate.

**ALUMINA**, or aluminum oxide, is the only known compound of aluminum and oxygen. It is

formed as a white smoke when aluminum powder burns in air, and as dross when aluminum is melted. An extremely thin layer of it always covers the surface of all solid or molten aluminum, protecting it from the air.

It occurs in nature in nearly pure form as the ruby, and in impure form as corundum or emery, which is nearly as hard as the diamond, hence its use in the form of the "emery wheel." Such wheels are no longer made of natural emery but of nearly pure alumina that has been melted in the electric furnace. It also occurs combined with water as a hydrate ( $\text{Al}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$  or  $\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$ ) in the mineral *BAUXITE*, and combined with silica in common clay.

Pure alumina is extracted from bauxite by a chemical process (digestion with caustic soda solution, followed by precipitation as hydrate) and used as an ore to produce aluminum. It is very inert, non-poisonous, and melts at about 3700° F. Its high melting point makes it an important constituent of many high grade refractories. F. C. F.

**ALUMINA CEMENT.** See CEMENT.

**ALUMINUM**, a silvery white metallic element, is characterized by its lightness, being about one-third as heavy as steel, copper or brass, as well as by its softness and workability. It is a good conductor of heat and electricity, reflects light well, and radiates heat slowly. It is little affected by moist air, chemical fumes, sulphur gases, and the like, and retains its color well under ordinary circumstances of use. It is made by the electrolysis of ALUMINA dissolved in molten cryolite at about 1,800° F. It melts at about 1,220° F., and boils at 3,270° F. Stamped into thin flakes, it forms a powder, which is the basis of aluminum paint. It may be rolled into sheets of varying thickness down to foil 0.0003 in. thick, may be drawn into tubing, extruded as "molding" in a variety of simple and complicated shapes, and worked by spinning, hammering, pressing, and other metal-forming methods. It is even beaten into leaf 20 millionths of an inch thick, for use in signs and photoflash lamps. When cold worked, it becomes stronger and less ductile, but the original softness, and ductility may be restored by annealing at 650°-900° F. Chemical symbol Al; atomic weight 27.11; sp. gr. 2.56; weight per cu. ft. 169 lbs.

**Aluminum Alloys.** To harden and strengthen aluminum, it may be alloyed with other metals, and some of the resulting alloys may be worked and heat treated. The most important alloying ingredients are copper, silicon, magnesium, manganese, nickel and zinc. For castings, alloys with copper up to 12%, or silicon up to 13% are most commonly used, with or without additions of small amounts of the other metals named above. Certain alloying ingredients in proper amount and combination very much improve the casting qualities of aluminum.

Aluminum pistons for internal combustion engines are usually cast in iron molds, from an alloy containing about 10% of copper, but most castings are made in sand molds from alloys containing either 4 or 8%



copper, 5, 10 or 12½% silicon, with or without smaller amounts of other metals. The silicon alloys have the best casting characteristics, permit the use of the thinnest walls, and have the best resistance to corrosion, but the copper alloys are generally stronger and harder, and have a higher yield point, and machine better. The alloys containing 4% copper may have their strength and ductility considerably improved by heating for many hours at about 900°F. and quenching in water.

Until recently, practically all wrought aluminum rod, wire, sheet, foil, tubes, and the like, were made of commercially pure aluminum (99%), or of an alloy containing about 1.25% manganese. The recently developed manganese alloy is harder, stronger, and somewhat less ductile than commercial aluminum, but equally as corrosion-resistant. Both are produced in a series of tempers; annealed, quarter hard, half hard, three-quarters hard, and hard. The softer tempers are used as stock for drawing, spinning, and similar operations, and the others are employed where greater hardness, higher yield point or better machine ability are desired.

Within the last 15 years, the strong wrought aluminum alloys of the duralumin type have been commercialized. Their high strength results from a heat treatment employed after the article has been given substantially its final form by rolling, forging, or drawing. The purpose of the heat treatment is to dissolve one or more constituents (such as copper or magnesium silicide) in the aluminum at the elevated temperatures, where they are much more soluble than at room temperature. Upon quenching in water and subsequent aging, the excess of the dissolved constituents precipitates out in a very fine state of division, causing a great increase in strength and hardness. The best known variety of these alloys, duralumin, contains approximately 4% copper, 0.5% manganese, 0.5% magnesium, and a smaller amount of silicon. It has substantially the tensile strength of mild steel. Another group which is somewhat easier to work, contains a little more copper but no magnesium. Upon aging at 250°F., its physical properties become similar to those of duralumin.

A softer, still more workable class of strong alloys is free from copper and manganese, but contains usually .6 to 1% of magnesium and silicon.

These strong alloys were at first chiefly used for dirigible and airplane construction, but are now being furnished in a variety of forms, including the usual structural shapes, for general purposes. Their future development promises to be of great importance. *See also METALS, LIGHT.*

F. C. F.

**ALUMINUM ACETATE**, a chemical compound,  $\text{Al}(\text{C}_2\text{H}_3\text{O}_2)_3$ , generally prepared as solution of aluminum acetate (Burow's solution) which contains about 5 per cent of neutral aluminum acetate. A slight modification of this is aluminum subacetate,  $\text{Al}(\text{C}_2\text{H}_3\text{O}_2)_2\text{OH}$ , the official solution of which contains about 8 per cent of the basic compound. Both solutions are used as astringent washes, as in burns.

**ALUNDUM**, an artificial ABRASIVE made by fusing oxide of aluminum in an electric furnace.

**ALUNITE**, a natural hydrous sulphate of aluminium and potassium. It crystallizes in the HEXAGONAL SYSTEM and occurs as crystals and in compact masses, usually white, grayish or reddish, varying from transparent to nearly opaque. Alunite forms as the result of the action of sulphurous vapors on trachytic and allied rocks, and sometimes occurs as the GANGUE, or waste material, of certain ORE DEPOSITS. It was first discovered near Rome in the 15th century and was later named aluminilite, a name changed in 1824 to alunite. It is mined as an ORE of POTASSIUM, occurring in the western United States, Italy and Hungary. *See also TRACHYTE.*

**ALVA, FERDINAND ALVAREZ DE TOLEDO, DUKE OF (1508-82)**, Spanish statesman and soldier under Charles V and Philip II. Born of one of the most illustrious families in Spain, he entered the army, and early gave proof of his personal bravery and military ability. At the age of 26 he had become a general, and at 30 he was made commander-in-chief of the Spanish forces. His skill won for him the title of Duke of Alva. In 1567 he was sent to the Netherlands, then in revolt against the Inquisition and the oppressive political domination of Spain, with orders to employ severe measures against the insurgents. He set up the "Council of Blood," which caused thousands to be executed, among the number Count Egmont and Count Horn. William of Orange, the leader of the insurrectionists, together with a great number of others, escaped from the Netherlands before Alva arrived, and organized resistance to his inhuman persecutions. In 1572 the Water Beggars captured Brill at the mouth of the Meuse, whence the insurrection spread through all the northern provinces. Baffled by the combined resistance, Alva was recalled at his own request in 1573, having executed 18,000 persons. His incitement of the populace to rebellion ultimately cost Spain dearly, for rebellion did not cease until seven of the finest provinces had thrown off the Spanish yoke.

**ALVA**, a city in northwestern Oklahoma, the county seat of Woods Co., situated on the Salt Fork of the Arkansas River. Two railroads serve the city. Alfalfa, wheat, corn and oats are raised in the district. The chief local industries are flour milling, broom manufacture and the making of dairy products. The Northwestern State Normal School is located here. Pop. 1920, 3,913; 1930, 5,121.

**ALVARADO, PEDRO DE (1495-1541)**, Spanish conquistador, born in Badajoz. He accompanied Grijalva from Cuba to Yucatan in 1518, and in 1519 he sailed as a commander of one of the 11 ships taken by Hernando Cortes for the conquest of Mexico. He was made second officer of the expedition and was left in charge when Cortes was called to the coast after the capture of Mexico City. Soon the threatening attitude of the Indians alarmed him and he attacked and killed thousands of them to prevent conspiracies. This brutality so angered the Indians

that, when Cortes returned, it was found necessary to retire. This was accomplished June 30, 1520, and Alvarado saved himself from the Indians by a vaulting leap that carried him across the drawbridge leading from the city. He subsequently participated in the reconquest of the city and in 1524 conquered Guatemala and was named governor by the emperor, Charles V. In 1534 he received a grant of land in South America and sailed to Peru to contest the territory then being conquered by Pizarro, but instead of proceeding with his plans, he allowed himself to be bought off and returned to Guatemala. Later he made a trip to Spain and was made governor of Honduras as well as of Guatemala. He was killed during the War in Mexico in 1541.

**ALVAREZ QUINTÉRO**, the surname of two Spanish dramatists, brothers, Serafín (1871- ), and Joaquín (1873- ). Serafín Alvarez Quintéro was born at Utrera, Mar. 26, 1871, and his brother, Joaquín, at Utrera, Jan. 21, 1873. In 1888 they left Seville, where they were educated, for Madrid, and began writing short plays, many with an Andalusian setting. These masterpieces of sparkling humor had such instant success that the Quintéros were encouraged to devote their talents to comedies. H. GRANVILLE-BARKER has translated a number of their plays into English, among them *The Women Have Their Way*, *A Hundred Years Old*, *Fortunato*, and *The Lady from Aljaqueque*.

**ALVERSTONE, RICHARD EVERARD WEBSTER**, 1st Baron (1842-1915), lord chief-justice of England, was born Dec. 22, 1842. He was educated at King's College, Charterhouse and Cambridge; in 1868 he became a barrister; in 1878 he was appointed Queen's Council. In 1885 he was made attorney-general, holding the post, except for two intervals, until 1900. He was Great Britain's delegate at the Behring Sea Arbitration dispute 1893, the British Guiana boundary matter in 1898, and the Alaska Boundary Commission in 1903. Raised to the peerage in 1900, he was made lord chief-justice, retiring in 1913. He died at Cranleigh, Surrey, Dec. 15, 1915.

**ALYSSUM, SWEET** (*Lobularia maritima*), a low plant of the MUSTARD family, native to Mediterranean countries, many varieties of which are grown for ornament. The profusely branching leafy stems bear long clusters of small, white, honey-scented flowers. Sweet alyssum is one of the commonest garden subjects and is readily grown as an annual, both indoors and out.

**AMADEUS I, FERDINAND MARIA** (1845-90), King of Spain, was born on May 30, 1845, the second son of Victor Emmanuel of Italy. He was elected King of Spain by the Cortes on Nov. 16, 1870, accepted the crown, and reached Madrid on Jan. 2, 1871. Since his reign of two years was marked by repeated uprisings and an attempt at assassination, he abdicated on Feb. 11, 1873, and returned to Italy. He died on Jan. 18, 1890.

**AMADIS OF GAUL**, the hero of one of the cycles of medieval romances. The earliest extant account

is a late 14th century prose work in Spanish, which may have had a Portuguese original. A French version by Herberay appeared in 1540. Amadis appears as a Prince of Gaul, seeking the love of Oriana, princess of England. The entire story, which is full of preternatural and fantastic creatures and events, is the series of his adventures in his attempt to marry her, which he eventually does.

**AMALEKITES**, in Biblical times a nomadic tribe of predatory instincts, comparable with the modern Kurds and wandering like "grasshoppers for multitude" (Judges 6:6). Even in battle they were attended by their families. With the Israelites, leaving Egypt, they started a feud that lasted for centuries. At Rephidim (Exodus 17) Moses with his rod sat enthroned on the hill, Aaron and Hur uplifting his hands while Joshua defeated the Amalekites on the plain below. As the Israelites approached the promised land the Amalekites, with the Canaanites (Numbers 14:45), again attacked the immigrants and "discomfited them, even unto Hormah." Over these irreconcilable tribesmen Gideon, the judge, was victorious; and Saul, as king, harried them in a war of extermination to the frontiers of Egypt. To the student of ethics the slaughter of the Amalekites has ever raised the question whether any circumstances justify such punitive measures. Not only did the prophet Samuel order the massacre but when Saul spared Agag, the Amalek chieftain, Samuel withdrew his support from the throne. David continued a pitiiless warfare in which the Amalekites destroyed Ziklag and enslaved the inhabitants, being themselves destroyed in revenge (I Samuel 27, 30). Probably Agag is a dynastic title like Pharaoh, and in the story of Esther the intense hatred for the Jews' enemy, Haman, is expressed in the statement that he was "an Agagite."

**AMALFI**, a seaport in the southwestern part of Italy, rising on a steep cliff from the Gulf of Salerno. It is a seaside resort, and the seat of an archbishop. Its people are engaged in fishing and handicraft of various sorts. The richest subtropical vegetation flourishes round the maze of houses, stairways, bridges and roof-gardens. Fine paved roads lead to Salerno and other points. The 11th century cathedral is in the Lombard-Norman style and is interesting despite later alterations. Its bronze doors were the work of Byzantine artists. Built on a promontory to the west of the town is the former Capuchin monastery, now a hotel. Amalfi was one of the most thriving ports of Italy from the 8th to 12th centuries. Pop. 1931, 7,598.

**AMALGAMATED CLOTHING WORKERS OF AMERICA**, a trades union of the men and women employed in the manufacture of men's suits and overcoats. Organized in 1914, with only a few members, it had grown, by 1920, to a membership of 125,000, had made collective agreements with the leading clothing manufacturers of the United States and Canada and had improved working conditions in the clothing industry. Workers' wages have been raised until they are among the highest in American

manufacturing industries; their working hours have been reduced from more than 60 to 44 a week; and, excepting in New York City and to a lesser extent in Baltimore, the small contract shop has been replaced by large, modern factories. These changes of the industry have been accompanied by the development of an advanced system of industrial relations. For the administration of agreements and for the adjustment of disputes, there exists a kind of arbitration court which has come to be regarded as a model.

In the exercise of its power in the industry, the Amalgamated has assumed more and more the responsibility for efficiency, the elimination of waste, modern methods of production and for the introduction of relief measures for the unemployed. Latest experiments in this direction comprise operation of shops by the union, of which the best example is the union-owned and union-managed factory in Milwaukee, Wis. In its unemployment program, it has adopted the rule of the equal division of work among all employees during the slack seasons; it has created in Chicago, New York, and Rochester unemployment insurance funds, and has arranged for the payment of a separation wage.

Since 1922 the Amalgamated has extended activities into the field of cooperative enterprises. It owns and operates two banks in Chicago and New York City, and in the latter city has built and operates cooperative apartment houses in the Bronx and East Side which together house nearly 750 families.

L. W.

**AMALGAMATION**, in ore treatment, a process for treating free milling gold ores. The ore is finely crushed, usually in STAMP BATTERIES, and passed over silver-coated copper plates which have been covered with mercury. The gold combines with the mercury to form amalgam, which is scraped off from time to time. This amalgam is heated in retorts, or furnaces, to drive off the mercury, the remaining mass of gold being melted into bullion. *See also* ORE TREATMENT; MILLING, FREE; HUNTINGTON MILL.

**AMALGAMATION**, a term applied to the establishment of unified control over two or more businesses which before such amalgamation have been separate and usually competing units. Amalgamation differs from merger in that it usually takes place between two firms only and it is implied that the outward semblance of a state of independent identity shall continue after the fusion. It is generally effected when one company buys stock control of another, when a new company is formed to acquire the whole or controlling portion of the stock of the companies involved, when one company buys another business outright or when a third company is formed to acquire the two companies by outright purchase. *See also* COMBINATIONS AND MERGERS; MONOPOLY; TRUSTS; CARTEL.

**AMALGAMS**, alloys in which mercury is one of the components. Many amalgams of the lighter metals (antimony, bismuth, arsenic, etc.) are easily formed by bringing them into direct contact with mer-

cury. Other methods used for metals which do not combine so readily comprise adding mercury to a solution of a metallic salt; placing a metal in a solution of mercuric nitrate; placing the mercury and metal together in a dilute acid; and electrolyzing a metallic salt with mercury as the negative electrode. Natural amalgams of gold and silver have been found in various regions. Amalgams containing a large proportion of mercury are usually liquids; others are of crystalline form. The important amalgams are those of copper, cadmium, gold, silver, tin and zinc. One of the principal uses of the amalgamation process is in the separation of gold and silver from its ores. *See also* METALS; METALLURGY; MINERALOGY; AMALGAMATION.

**AMANA COMMUNITY**, a communal settlement occupying about 25,000 acres in Iowa and embracing seven villages, the chief of which are Amana, South Amana, and Homestead. Followers of the True Inspiration Society, a German religious group of 18th century origin, in 1820-40 concentrated in Armenburg, Germany, about two leaders, Christian Metz and Barbara Heynemann, who claimed divine inspiration. Metz was instructed by vision to lead the entire congregation to the United States. In 1842 Metz and four others arrived in New York, and bought about 5,000 acres near Buffalo. Within two years he was joined by 600 followers, who formed the village of Eben-Ezer. Communistic organization was instituted in obedience to an inspiration. Increase of membership was followed by inspiration to move westward; in 1855 lands were purchased in Iowa. Each of the seven villages manages its own accounts, and has a separate schoolhouse and store and, in some, factory. Thirteen trustees, elected annually by male vote, supervise each community. The folk live in private houses, but eat in common dining halls where the sexes are segregated. The society exalts labor, discourages frivolity, and exercises some supervision over the marriage of its members. Food is substantial and ample; dress is plain; houses are unpainted, but have flower-beds. The population in 1931 was about 1,500. In the summer of that year the society abandoned its communistic policy.

**AMANITA**. Several of the most deadly of poison fungi belong to this genus of white-spored agarics. Among the variable, and often very beautiful, species, an expert only can distinguish the few which are edible. The mark of the genus is the presence on the stem of both a ring and a volva. The ring, or membranous collar, is found near the cap. The volva, a remnant of an outer veil which once enveloped the young plant, persists as a cup (the "death-cup") or as scaly rings, sheathing the base of the bulbous stem. Shreds of it may remain as warty patches on the cap. Unless care be taken to gather the stem entire, the significant volva may be left in the soil. Two of the most dangerous species, both having white gills, are the "deadly Amanita," or "destroying angel" (*A. phalloides*), usually found in the woods, which is colored white, yellowish, olive,

or umber, and the "fly agaric" (*A. muscaria*) which ranges from vivid orange-red to pale yellow, warted with white. For the poison of the first, phallin, there is no known antidote. The effect on the heart of muscarine from the fly agaric may be counteracted by atropin.

**AMANULLAH KHAN** (1892- ), formerly Amir of Afghanistan, was born June 1, 1892, the third son of Amir Habibullah and grandson of Abdur Rahman. On February 20, 1919, Habibullah was assassinated. Amanullah had been governor of Kabul. He seized the treasury and assisted by his mother declared himself Amir. Amanullah set himself to introduce western civilization, including education for women. In 1924, there were signs of revolt among the tribesmen fomented by the Moslem clergy, but in 1927, Amanullah undertook a tour in Europe proceeding by Egypt and returning through Russia. Amanullah was greatly impressed by the modernization of Turkey by Kemal, and he noted the rise of Risa Khan in Persia. Hence the Amir attempted the task of modernizing Kabul. A bandit chieftain called Bacho Sakao or the "water boy" rose in rebellion, and on January 14, 1929, Amanullah abdicated. In May Amanullah left the country with Queen Souriya and proceeded to Italy where their reception into the Roman Church was announced. Bacho Sakao reigned under the adopted name, Habibullah, but in October, 1929, Nadir Khan who had served Amanullah as Foreign Minister but was living in France, returned to Afghanistan and drove the usurper from the throne.

**AMARANTH**, a genus (*Amaranthus*) of annual herbs of the amaranth family. There are about 60 species, natives of tropical and temperate regions, many of which are widely distributed as weeds, commonly called pigweeds. They are mostly coarse plants with alternate, entire, sometimes prickly-tipped leaves and small green or purplish flowers in spiked clusters. Several species, as *A. tricolor* or *gangeticus*, are grown as potherbs in India; the tassel amaranth is cultivated in the tropics for its edible seeds used as a cereal. Among the species planted for ornament are love-lies-bleeding (*A. caudatus*), prince's-feather (*A. hybridus* var. *hypochondriacus*) and the tassel amaranth, a form of *A. caudatus*. In poetic literature the amaranth is an imaginary plant with flowers that never fade.

**AMARILLO**, a city and the county seat of Potter Co., situated in northwestern Texas, 220 mi. northwest of Abilene. Bus lines, airlines and three railroads serve the city. The principal crops of this vicinity are wheat and grain sorghum. Highly productive gas and oil fields have made Amarillo the commercial center of the Panhandle region. The recovery of helium used in airships from the natural gas of the region is carried on by a United States Government plant. The local industries include grain elevators, flour mills, cotton oil mills, cotton gins, oil refineries and carbon black, meat packing and zinc refining plants. In 1929 the value of the manufac-

tures was about \$5,000,000; the retail trade amounted to \$30,095,199. The city was founded in 1887 and adopted the commission-management form of government in 1913. Pop. 1920, 15,494; 1930, 43,132.

**AMARYLLIS**, a beautiful bulbous plant (*A. Belladonna*), native to South Africa, many forms of which are cultivated under the name belladonna lily. The solid stem, about 2 ft. high, bears at its summit a cluster of large, fragrant, rose-red flowers, about 3 in.



GARDEN AMARYLLIS  
*Hippeastrum hybridum*

long, which appear before the leaves. Some cultivated kinds have flowers of various colors, as purple, white and white striped. Several related plants, especially species of *Hippeastrum*, are grown as amaryllis.

**AMATEUR**, in athletics, one who engages in competitive sports purely for amusement. In the United States, an amateur may accept cups, medals and similar prizes, the cash value of which is strictly limited. The rules of the AMERICAN AMATEUR ATHLETIC ASSOCIATION hold throughout the country. In track and field meets, any amateur who contends with professionals loses his amateur standing. This also applies to football, tennis and other sports. In golf, however, professionals and amateurs meet in the annual open championship. Recently there has been discussion of a similar open tennis championship. With a few minor exceptions, these rules obtain in England and Europe. In both England and the United States, amateur horsemen compete with professional riders, the word Mr. designating the amateur. In England this distinction is made when amateur cricket players meet professionals.

**AMATEUR ATHLETIC UNION OF THE UNITED STATES**, an organization which has jurisdiction over amateur sports except tennis, golf, baseball, football and rowing. Organized amateur athletics may be said really to date from the founding of the New York Athletic Club, 1866. The club held the

first American track and field championships in 1876. It arbitrarily took control of the government of athletics and made the athletic laws, which were patterned very much after the rules common at that time in Great Britain. Popularizing athletics was largely confined to the City of New York by this club. After years of uphill work, track and field athletics began to assume a national importance, and other clubs were organized in New Jersey, Chicago and Boston, and at times competition in athletics from these sections were held. Lack of organization became apparent, for it was impossible for an athlete to know with whom he was competing. When local athletic contests were held the contestants, as a rule, knew each other; but the games were few and far between, and amateurs and professionals competed in the same events. In the years 1877-79, a number of athletic clubs were organized in the United States, several of them in the vicinity of New York where a strong rivalry existed. In 1879 the New York Athletic Club decided to give up the management of the track and field championships and agreed to the formation of the National Association of Amateur Athletics of America, better known as the N.A.A., which then became the governing body. The personnel of this association consisted of 14 clubs, in 1880, 12 of them being located in and about New York City, one in San Francisco, and one in Boston.

**Charter Members.** The formation of a national governing body that would control all sports, make stringent laws and assist in the development of athletics for the United States was actually started in the year of 1885. The New York Athletic Club became dissatisfied at that time with the N.A.A.'s and resigned from it. Dissatisfaction became general, and on Sept. 14, 1887, the New York Athletic Club called a meeting at the instigation of the athletic club of the Schuylkill Navy to express dissent with the way in which the affairs were being handled by the N.A.A.'s, and also the concentration of competition to the City of New York. Sympathy with the movement was received from the Chicago Athletic Association; Chester City, Pa., Athletic Club; Pullman, Ill., Athletic Club, and the Fencing and Sparring Club of Philadelphia.

At the Oct. 1, 1887 meeting, a committee was named to draw up a constitution for a new organization, the Amateur Athletic Union (A.A.U.), and by-laws, which were adopted at a meeting held Jan. 1, 1888 in New York. The following clubs became charter members: Athletic Club of the Schuylkill Navy, Philadelphia; New York Athletic Club; Detroit Athletic Club; Chicago Amateur Athletic Association; Columbia Athletic Club, Washington, D.C.; New Jersey Athletic Club, Bayonne, N.J.; Staten Island Athletic Club, West Brighton, N.Y.; Pastime Athletic Club, New York; Olympic Athletic Club, New York; Cape May (N.J.) Athletic Club; Warren Athletic Club, Wilmington, Del.; Chester City (Pa.) Athletic Club; Nassau Athletic Club, Brooklyn, N.Y., and Scottish-American Athletic Club, Jersey City, N.J. The first officers of the new organization were Pres., Harry McMillan, Athletic Club of the Schuylkill Navy; Vice Pres.,

F. W. Eddy, Detroit Athletic Club; Secy., Otto Ruhl, New York Athletic Club; Treas., Howard Perry, Columbia Athletic Club, Washington.

Within two months the A.A.U. had a membership of a couple of dozen clubs and gave its first boxing, wrestling and fencing championships in New York City, Apr. 6, 1888; its first gymnastics in New York, Apr. 28, 1888; and its first outdoor track and field championships in Detroit, Sept. 18, 1888.

In 1889 James E. Sullivan was elected secretary to succeed Otto Ruhl and continued a power in that office until his death in 1914, with the exception of the time he occupied the position of president for two successive terms, 1906 and 1907. Sullivan became the foremost figure in amateur athletics in the United States, was a champion and disciple of William B. Curtis, the Father of American Athletics, and took up the reins of government upon the death of Mr. Curtis.

Sullivan for years was the embodiment of amateur athletics in the United States. He was commissioner of Physical Education at the World's Fair at St. Louis in 1904, where the Olympic Championships were held and organized, and piloted the American Olympic teams to Athens in 1906, London in 1908, and Stockholm in 1912. He was assistant to A. Spalding, who was Olympic Commissioner to the Olympic Games at Paris in 1900. He helped organize the New York Public Schools Athletic League, and attained an international fame in athletic sport, being the first to represent America in the International Amateur Athletic Federation, the body whose rules govern the contests in the Olympic games and which now practically makes the rules for amateur track and field competition throughout the world. To James E. Sullivan's personality, honesty, energy and untiring zeal may be attributed the remarkable growth that amateur athletics have obtained everywhere.

**Conflict with Rival Organization.** The formation of the A.A.U. and its public proclamation that it would control amateur sport in the United States led to a warfare with the N.A.A.'s, and the announcement the latter would hold a western championship meeting to offset the championship of the A.A.U. held in Detroit led to the passage of the following resolution by the A.A.U. Aug. 1888: "RESOLVED: That any amateur athlete competing in any open athletic games in the United States under the rules approved of by the National Association will be debarred from competing in any games held under the rules of the A.A.U." The resolution was adopted and immediately took effect. Those athletes who were members of the Manhattan Athletic Club of New York, a strong rival of the New York Athletic Club, and the backbone of the N.A.A.'s, did not disqualify themselves until after the Detroit meeting in which they competed. The N.A.A.'s, after the Detroit Championships were held, announced its own championships, and they were held without the sanction of the A.A.U. All athletes who competed in it were automatically disqualified from competing in any meeting under the sanction of the A.A.U. and then, for nearly a year, the

bitterest kind of an athletic warfare existed over the country.

Feeling injury had been done to athletes, Col. A. G. Mills, of the New York Athletic Club, and A. C. Stephens, of the New Jersey Athletic Club, two of the ablest men on the A.A.U. board of governors, presented Pres. Harry McMillan a plan to end the conflict, and he appointed a committee to confer with a like committee of the N.A.A's. To Mills and Stephens went the credit for the termination of hostilities and making the A.A.U. of the United States a much stronger body. The National A's agreed to take its clubs into the A.A.U., relinquish control and go out of existence, thus giving the latter a free field of Amateur Athletic Sports in the United States. The A.A.U. spread its wings until every corner of the country was under its care. The Mills Reorganization Plan, as adopted by Col. A. G. Mills in 1890 was accepted, and in the spring of 1891 the associations, thus formed as Metropolitan Association, New England Association, Atlantic Association, Central Association, and Pacific Association held conventions and elected their own officers and their four delegates each to the national convention of the A.A.U., the national body. The A.A.U., because of the numerous associations affiliated with it, is the biggest amateur sports governing board in the world. J. J. H.

**AMATI FAMILY**, Italian violin-makers, who lived and worked at Cremona. Andrea Amati (1520-1611) importantly altered the shape of the violin. His instruments still extant are of small size and give forth a clear but not powerful tone. Andrea's sons, Antonio Amati (1550-1638) and Geronimo (1551-1635), made somewhat larger instruments. The most eminent member of the family, Nicolo Amati (1596-1684), added grace to the outline of the violin, giving it better calculated proportions, and greater power. He made the "Grand Amatis" now much prized. His pupils numbered STRADIVARI and Guarneri.

**AMATOL**. See TRINITROTOLUENE.

**AMAZON**, a river of South America, the most extensive inland waterway in the world. Its length is about 4,000 mi.; with more than 200 tributaries this great fluvial system drains an area of 2,722,000 sq. mi.

The Amazon rises in the ANDES close to the town of Huanaco in Peru, its birthplace being the lake of Lauri Cocha; from here, augmenting in volume, it passes through the high mountain valleys, increasing in muddiness as it flows from south to north. It continues in this direction until arriving at a point where it flows through two huge walls of rock, after receiving the waters of the Santiago, forming the rapids called Pongo Manseriche, from whence its course abruptly changes to the east, which is continued until its arrival at the Atlantic Ocean, near the Equator in Brazil. During the river's progress it is known by three names: Marañon, from its source to the mouth of the Napo; Solimoes, until it reaches the NEGRO; and Amazonas from the Negro to the mouth. About 2,500 mi. of its course is through Brazil.

**Navigation**. One of the charms of this great waterway is that it is navigable for thousands of miles. Steamers go right up to Iquitos, although the old Spanish settlement lies 2,300 mi. from the Atlantic, and the river here is a mile wide. Vessels drawing 14 ft. of water go 486 mi. higher up to Achual Point. The Madeira is much the greatest of the navigable tributaries; Porto Velo can be reached by vessels of 6,000 tons, but above that point there are over 200 mi. of rapids on the main river and the Mamore before the long stretches of navigable water on the Bolivian rivers are encountered. Neither the Tapajos nor the Xingu can be navigated except for short distances, owing to the occurrence of rapids within about 100 and 200 mi. respectively of their confluences with the main river. The Purus and the Jurua, however, are navigable for small craft to the borders of the Acre Territory, and the Ucayali and the Huallaga to the foot of the Peruvian Montana. Navigation on the north bank tributaries does not extend very far for vessels of any size except on the Japura and on the Negro-Branco system. The underlying hard rocks crop out in the beds of the streams flowing southeastwards from the Andes, along a line about 400 to 500 mi. distant from the mountains. The lower rapids on many of the tributary streams of the Amazon are by no means a complete bar to the passage of craft. Canoes and launches can often use the rivers, especially when the water is high, for great distances above the limits of navigation for steamers; and where it is impossible even for small craft to negotiate the obstacles, there are frequently long stretches of smooth navigable water above them, the merchandise such as rubber on the upper tributaries of the Amazon and cattle on the higher sections of the river Branco being taken round the rapids or falls and re-embarked on larger vessels below. The Amazon has a fall of less than 2½ in. per mile on its course from Iquitos to the sea, and is thus far the most notable navigable river in the world.

**Tributaries**. The Amazon has 21 tributaries more than 700 mi. in length. Of these 11 exceed 1,000 mi. in length, and three pass the 2,000 mi. mark. The longest and most useful of the affluents flow from south to north. They are not all navigable for equal or proportionate distances. The line joining the points of the first occurrence of rapids on the tributaries of the master-river takes a very distinctive course. There is a difference of opinion as to whether the Ucayali or the Marañon should be regarded as the true source of the main river. The two great tributaries east of the Ucayali are the Jurua and Purus. The Madeira is the greatest of all the Amazon tributaries and drains an area of about 500,000 sq. mi. in Brazil, Bolivia and Peru. The Negro holds a unique place among the Amazon tributaries. It is the great prototype of all "black" water affluents. In this region the rivers are divided into two main groups, according to the color of their waters. The "white" rivers, of which the Purus and the Jurua are the most typical



representatives, flow in successive curves, loops and horseshoe bends. The "black" water rivers flow in straight stretches. Some rivers, such as the Xingu and Tapajos, do not belong to either of these classes, as their water is clear, being lacking both in sediment and coloring matter.

**Lower Amazon.** Only about 10% of the water discharged by the Amazon enters it below Obidos, very little of which is from the northern slope of the valley. The drainage area of the Amazon basin above Obidos is about 1,945,000 sq. mi., and below only about 423,000, or 20%, exclusive of the 354,000 sq. mi. of the Tocantins valley. The width of the mouths of the Amazon is usually measured from Cabo do Norte to Ponto Patiçoca, a distance of 207 mi., but this includes the ocean outlet, 40 mi. wide, of the Para River, which should be deducted, as this stream is only the lower reach of the Tocantins. If any portion of the waters of the Amazon finds its way round the southern side of the large island of Marajo into the River Para, it is only through broad natural canals, which are in no sense outflow channels of the Amazon. The tides here are characteristic of those of an estuary, depending on numerous and ever-changing factors. When beyond the reach of local influence, spring tides are 14 ft. and neap, 10 ft. In certain localities flood tides run from 6 to 10 mi. an hour. Following the coast, a little to the north of Cabo do Norte, and for 100 mi. along its Guayana margin up the Amazon, is a belt of half-submerged islands and shallow sandbanks. Here the tidal phenomenon called the bore occurs, where the soundings are not over 4 fathoms. It commences with a roar, constantly increasing and advances at the rate of from 10 to 15 mi. an hour, with a breaking wall of water from 5 to 12 ft. high. Under such conditions of warfare between the ocean and the river it is not surprising that the former is rapidly eating away the coast. Notwithstanding the vast volume of silt carried by the Amazon the river does build up a delta because of the local subsidence of the land. The Amazon formerly flowed westward to the Pacific but was dammed by the uplift of the Andes and reversed its course, hence its valley narrows toward the mouth, the narrowest point being near Obidos.

**Flora and Fauna.** See SOUTH AMERICA; sections *Flora and Fauna*.

**Climate.** The climate in the Amazon region is nowhere characterized by excessive heat. The average temperature of the warmest month in Manaus is 81° F., with an annual rainfall of 65 in.; at Para the annual rainfall is 98 in. There are two seasons, the dry and the wet, known locally as summer and winter. The southern tributaries of the greater part of the course of the main stream experience their winter from November to May. The rivers begin to rise at the commencement of this season, and by January they are generally in flood; the level continuing high until May, when they are usually falling. On the northern tributaries the reverse takes

place, and the lowest period is generally January to February, the wet season lasting from March to September. In the upper regions there are no well-marked seasons; in the zone bordering on the mountains the streams respond to local falls of rain.

**Industries.** The industries of the Amazon region are mainly extractive and connected with forest products. The gathering of wild rubber for many years occupied the leading place, but now the collecting of Brazil-nuts is more important. Timber-cutting does not engage much attention, and the cultivation of crops is carried on only in a small way, though cattle-raising has sparingly developed in favorable parts. Difficulties of communication and the relative scarcity of rubber trees prevent the collection of balata developing into a large industry. The chief center for balata is Manaus, whence the product is exported and whither the gatherers go to spend their earnings. The castilloa rubber-yielding tree is exploited in the basins of the great tributaries of the Amazon from Araguaya to the Purus, especially on higher and better drained ground. The pará rubber tree (*Hevea brasiliensis*) is the most important of the rubber-producing plants.

**Discovery.** The mouth of the Amazon was discovered in 1499-1500 by Vincente Pinzon, who named it the "Fresh Water Sea." In 1539 Francisco de Orellana explored it from the west. He started to sail down a small river, which turned out to be what is known to-day as the Napo. After many vicissitudes he reached the Amazon and afterwards the Atlantic. Upon describing his voyage he asserted, and was believed, that his boat was attacked all the way by woman warriors with fair hair, who were savages, a story due perhaps to his imagining to be women the Amazon Indians, who have long hair and in many cases wear both capes and skirts of grass.

**AMAZONS,** in Greek mythology, were women warriors whose original home was in the Caucasus, whence they invaded countries as distant as Greece, Syria, Arabia and Egypt. Every year they met the



COURTESY M. M. OF ART

AMAZONS IN MEN'S IONIC CHITONS

Gargareans, a race of men separated from them by a mountain, so continuing their nation. Male children were returned to the fathers or put to death. Daughters were trained in riding, hunting and in cultivating the land, the discipline requiring that each girl should sacrifice her right breast.

**AMBALA**, a city and district of British India in the Punjab. The city is built a short distance from the River Shaggar. The railway station is on a branch line leading up to Simla. Ambala's strategic position resulted in the establishment of an important military cantonment. Pop. 1921, 76,326.

**AMBASSADOR BRIDGE**, a suspension structure over the Detroit River, linking the city of Detroit with Sandwich, Ontario, on the Canadian shore. Work was begun in May 1927, and the bridge was completed in Nov. 1929. The Ambassador bridge has a span of 1,850 ft., exceeding the Camden bridge by 100 ft., and has a total length, including approaches on both shores, of 7,400 ft. The main span is supported by 2 cables 19 in. in diameter, and containing 6,622 galvanized steel wires. The two towers are made of steel, consisting of cellular sections riveted together. The bridge roadway is 47 ft. wide, and an 8-ft. sidewalk extends the length of the structure on the west side. The cost of the project, inclusive of land purchased for the approaches, was \$22,500,000. It was built by the Detroit International Bridge Company, which will collect tolls for use of the bridge until its cost is covered. The traffic capacity is 5,000 vehicles an hour. The distance between Detroit and Niagara Falls is shortened 137 mi. by use of the bridge by continuous highway.

**AMBER**, a fossil resin popular for jewelry, cigar-holders, pipe-stems and various ornaments. The mineralogical name is succinite, because true amber contains succinic acid, which other similar resins do not. Amber varies in color from clouded white through yellow to reddish brown, and has a resinous appearance. Clouded, translucent varieties are popular, as well as those which are clear and transparent. The chemical constituents are carbon, hydrogen and oxygen, together with a small amount of sulphur in organic compounds.

Coals, particularly the younger and less altered varieties, such as **LIGNITE**, often contain amber and other similar resins. They are all the resins from trees, especially conifers, which grew in the coal swamps. Insects are often found encased in the now solid amber.

Amber was known to the ancients who called it *electrum*. The name electricity was derived from it because of the ease with which "*electrum*" assumes an electrical charge when rubbed. In Pliny's time amber was so highly valued that a small human effigy carved in it "had been known to sell for a higher price than living men."

A great deal of commercial amber comes from material washed up along the coast of the Baltic and North Sea. It is also found in Sicily, Mexico and India, in bituminous coals of southern France, and in New England and the States of New Jersey and Maryland. See also **COAL**; **GEM STONES**. S. F. K.

**AMBERG**, a city in the Bavarian Upper Palatinate on both banks of the Vils, about 36 mi. east of Nürnberg. It has busy factories producing enameled iron ware and compressed-air tools. The city has a well-

preserved wall with picturesque old gates, and is encircled by fine avenues. On the market place is the Rathaus of the 14th to 16th centuries, with a museum, and the 15th century late-Gothic Church of St. Martin, with the monument of Count Palatine Rupprecht, d. 1397. Across the river is the old electoral castle. Near it are the 17th century Jesuit College and St. George's Church, which was mentioned in 1091. Pop. 1925, 29,000.

**AMBERGRIS**, a solid, fatty substance of a marbled gray and black color, produced in the intestines of sperm whales. It is found floating on the ocean or cast ashore, and has been taken from slaughtered whales in masses weighing up to 2,000 pounds. Often the indigestible beaks of huge octopi are found embedded in masses of ambergris, which is thought to be produced by a diseased condition.

Ambergris has a peculiar sweetish, earthy odor, and is much used in expensive compounded perfumes, to fix and strengthen other ingredients. At one time it was used in medicine and in the East, in cookery. Owing to its rarity it brings a high price, a lump often profiting the whaler more than the whale's oil, and is extensively adulterated. Ambergris melts at 62° C. and is volatilized at 100° C. In hot alcohol it dissolves, yielding ambrein; it is soluble in ether, and in volatile and fixed oils.

**AMBIDEXTERITY**, the ability to use both hands with equal ease and skill in manual operations. This faculty may be developed to some extent through practice. Some investigators maintain that from birth there is dominance of one side of the brain, which accounts for the greater ability of one hand in the right- or left-handed person.

**AMBLESIDE**, a market town of Westmorland Co., England, situated in the lake district, 1 mi. from Lake Windermere, in the densely wooded valley of the Rothay. The neighborhood is celebrated as the home of Harriet Martineau, Matthew Arnold, and Wordsworth. There are Roman ruins near the lake-side. Woolen goods are manufactured. Pop. 1931, 2,343.

**AMBLYOPIA**, a dimness of vision from imperfect sensation of the retina, the nervous tissue at the back of the eye which receives the sensation of vision and transmits it to the brain. In amblyopia there is not apparent any organic change in the tissue of the eye. The term includes a number of varieties, such as that disturbance of vision which results from overdoses of alcohol or arsenic, overdoses of tobacco or similar toxic substances. These are characterized as tobacco, alcohol or arsenical amblyopia. Color blindness is sometimes called color amblyopia. There is another form which affects only one side, known as crossed amblyopia.

Dimness of vision may result from fatigue due to various causes. That associated with sexual excess is called postmarital amblyopia. If the dimness of vision is due to the fact that the individual has convinced himself that he cannot see, whereas examination indicates all of the tissues to be organically sound,

the condition is called hysterical amblyopia. In some cases in which people do not seem to see well at night, the condition is described as nocturnal amblyopia. M. F.

**AMBO**, one of the two pulpits or reading desks on the sides of the chancel of an early Christian Church. They were usually treated as decorated accents of the choir screen parapets, and were raised to a considerable height. Stair railings and the pulpit front were usually of paneled marble, sometimes with insets of contrasting colors. In the 12th century rich mosaic was used. Near the ambo on the left side stood the richly decorated Paschal Candlestick, as in San Clemente, Rome, 9th century. Free standing, single richly decorated pulpits such as those of Salerno, about 1175, are also loosely called ambones.

**AMBOINA**, also Amboyna, a town of the Dutch East Indies, capital of the residency and on the island of the same name. Well-built, with broad straight streets, public gardens and esplanades, it has important buildings such as the hall of justice, a hospital and an orphanage. The town is the commercial center of the Moluccas archipelago. In 1898 Amboina was practically destroyed by a severe earthquake. Coffee, cacao, spices and fruits are the chief articles of trade. Est. pop. 1930, 11,800.

**AMBOINA ISLAND**, an island of the Dutch East Indies, the most important of the group known as the Moluccas. It lies just off the island of Buru and is about 30 mi. long and 10 mi. wide. Its area is 262 sq. mi. The surface is mountainous, some of the peaks reaching to nearly 5,000 ft. above sea level. Cocoa, sago palms and nutmeg trees grow luxuriantly. Cloves, coffee, maize, yams and fruits are also produced. As a residency Amboina includes the islands of Buru, Amblau, Ceram, Manipa and several smaller ones. The total area of the Amboina residency is 17,372 sq. mi. and the combined population in 1927 was 360,000. The residency of Amboina forms part of the government of the Moluccas. Population of Amboina island alone in 1930 about 115,000.

**AMBRIDGE**, an industrial borough of Beaver Co., southwestern Pennsylvania. It is situated on the Ohio River, 16 mi. northwest of Pittsburgh and is served by the Pennsylvania Railroad, river craft and motor buses. Dairying and truck-farming are carried on in the vicinity. The city has large structural steel and metal products plants, electric conduit factories and various other industrial establishments. In 1929 the retail trade amounted to \$8,490,338.

Within the city limits, George Rapp, a German Communist, founded in 1824 what was known as Economy village. Industry and agriculture flourished in the community for about 50 years, when the society began to decline, to disband in 1906. The Great House of the village is now a historical museum. The borough was incorporated in 1904. Pop. 1920, 12,730; 1930, 20,227.

**AMBRIZ**, a seaport of Angola or Portuguese West Africa on the Atlantic coast at the mouth of the

Loje River. It is situated in the free trade district of the Congo basin between 7° 50' S. lat. and 13° E. long.; Loanda lies 70 mi. to the south. There are large deposits of copper in the vicinity. A fort, church and customs house constructed by the Portuguese late in the 19th century form the center of the present town. There are many factories, and an extensive trade in copper, India-rubber, coffee, palm oil and archil, a weed producing a violet dye, is carried on. Pop. 2,500.

**AMBROSE OF MILAN, ST.** (†340-397), scholar and statesman, was born about the year 340 in the south of France. His father, also called Ambrosius, was prefect of Gaul, one of the greatest provinces in the Roman Empire, and from him his son inherited a patrician courtesy. At the father's death the family returned to Rome where Ambrose, more fortunate in this respect than Augustine, was brought into touch with Greek as well as Latin culture. Also he owed much to a devout mother and to his somewhat older sister, Marcellina, who had taken the veil and impressed on him the sanctity of the celibate life. After study of the law he was appointed a consular governor with his capital at Milan, and as he set forth Anicius Probus, the Praetorian prefect, unwittingly prophetic, advised him to "conduct himself not as a judge but as a bishop." Milan was seething with ecclesiastical controversy. A Nicene bishop, Dionysius, had been driven forth and a triumphant Arian from Alexandria, Auxentius of Cappadocia, though denounced by St. Hilary of Poitiers, held the see for 18 years. In 374 he died, and an excited multitude of clergy and people gathered in the Basilica. Ambrose, being responsible for order, pleaded for conciliation; a voice, said to be a child's, cried, "Ambrose, Bishop." A catechumen, he had not been baptized as yet, but the acclamations were irresistible. In a few days baptism, ordination and consecration raised him to the episcopal throne, which he occupied until he died 23 years later. After making provision for his sister, Ambrose gave his goods to the poor and his lands to the church.

His brother, Satyrus, relieved him of temporal cares and he was able to devote himself wholly to his spiritual studies and responsibilities. A frugal life, an open house to all who came to seek his aid or advice and a virile exposition of the faith endeared him to the people. An illustrious disciple, St. Augustine, describes him as one of those who, in the pulpit, "speak the truth and speak it well, judiciously, pointedly and with beauty and power of expression." So convincing was his plea for virginity that many mothers refused to allow their daughters to listen to him. Charged with depopulating the Roman Empire, Ambrose asked the young men whether any of them had difficulty in obtaining wives. Amid the confusion of a steadily disintegrating Christendom the Bishop upheld the prestige of the Church, thus becoming the prototype of THOMAS À BECKET, HILDEBRAND and ADRIAN IV. The Empress Justine was an Arian and, in his discourses, Ambrose compared her

with Jezebel, Herodias and an erring Eve, nor would he concede to her even one church for heretical worship. In Holy Week, 386, he refused to surrender his Basilica to the Empress and during several days he was besieged in the sacred edifice where hymns, composed for the emergency by Ambrose, were chanted, the very soldiers joining in the litanies. Finally the Empress realized that such a prelate was not to be overcome by force. A second incident demonstrated a similar courage. Faced by sedition in Thessalonica, the Emperor Theodosius had ordered a massacre of 7,000 citizens. Anticipating that Theodosius would attend Mass, Ambrose determined to resist such impiety. One tradition says that he shut the doors of his church in the Emperor's face. More probably he retired to the country and wrote his sovereign a letter demanding public penance. The Emperor submitted and, stripped of all royal emblems, confessed his error. Ambrose died in 397. His name is associated with an immense literature to which time has made inauthentic additions, the commentary on the Pauline Epistles, appearing under the name *Ambrosiaster*, being a case in point. As the "father of church music," Ambrose left behind him the Ambrosian chant, and numerous hymns are attributed to him, of which 14 are held to be certainly his work, with four others doubtful. Also there is the Ambrosian liturgy, special to Milan. Instructed by a dream, Ambrose disinterred the perfect skeletons of two martyrs, Gervasius and Protasius, already buried 300 years. The heads were separate from the bodies, and in Gibbon's words there was "a splendid effusion of blood." With these relics Ambrose was himself entombed, and when the Basilica was rebuilt in 835, they were placed in a porphyry sarcophagus under the altar, where they were found in 1864. The relics now rest in a modern silver coffin.

P. W. W.

**AMBROSIA**, the food of the Grecian gods, which made them not only immortal but eternally young. It was brought to Jupiter by pigeons and included ointment, whence the phrase "ambrosial locks of hair."

**AMBROSIAN CHANT**, named after the Bishop of Milan, St. Ambrose (c. 340-397), was that unaccompanied unisonous chant which became the foundation of all later liturgical Catholic music. It was apparently confined to the first four authentic modes, being a forerunner of the GREGORIAN CHANT which developed about two centuries later.

**AMBROSIAN RITE**, the rite used in the Church and province of Milan, Italy, also called the Milanese Rite. Its origin is disputed and it is called Ambrosian because its chief characteristics date from the time of St. Ambrose, Bishop of Milan (340-397). It has been greatly Romanized and now contains the entire Roman Canon of the Mass. Some of its peculiarities are a procession with oblations of bread and wine by the laity before the offertory; the litany chanted by the deacon; the creed said after the offertory; a different arrangement of the *Kyrie*; the absence of bell-ringing at the consecration; the breaking of the bread before the Our Father; the saying of the *Agnus*

*Dei* only at requiems. Also, the deacon and sub-deacon kneel at the north and south ends of the altar, respectively; there is a difference in the LITURGICAL COLORS in that Mass is not said on Fridays in Lent and black is used, as it is according to the Roman rite, on Good Friday only; the old Roman psalter is employed throughout, and nearly every feast has a proper preface. Pope Pius XI belonged to the Ambrosian Rite, which is used in most churches in the Milanese archdiocese and in some at Bergamo, Lugano and Novara.

**AMBROSIANS**, a religious order. Although he believed in monasticism, AMBROSE OF MILAN founded no specified religious order. In the 14th and 15th centuries, however, the Order of Ambrosians was inaugurated, with congregations for men and women. As Archbishop of Milan, St. CARLO BORROMEO organized the Oblates of St. Ambrose and St. Charles, a diocesan society of actual or prospective priests (see NERI, St. PHILIP), which Cardinal Wiseman with his successors, Manning and Vaughan, extended to England. The oblates take no vow of poverty but are available for any special task to which the Bishop assigns them, for instance, care of schools, a vacant parish or to conduct retreats.

**AMBUSH BUG**, a genus (*Phymata*) of heteropterous insects, of which six or more species are found in the United States. It is a strong, ferocious predatory bug, whose front legs are enlarged and fitted for grasping, and whose mouth parts are formed into a beak. The commonest species, *Phymata wolfii*, abounds in tropical and subtropical America. It is yellowish-green in color with a dark band across its abdomen. It frequents goldenrod and other yellow flowers which harmonize with its coloring and conceal its presence from its insect prey, when they visit the flowers.

**AMELIA**, Henry Fielding's last novel; published 1752. The story deals with the adventures of Captain Booth, a lovable spendthrift, and his wife Amelia, a paragon of conjugal virtues. It is woven around such 18th century scenes and circumstances as debtors' prisons, a villainous lord who plots Amelia's seduction and Booth's downfall, a bygone mistress who continually adds complications, and finally, a legacy which solves all difficulties. The character of Amelia was based on that of Fielding's first wife.

**AMEN**, a Hebrew word meaning true. Employed by Jews, Christians and Moslems, it is among the most widely known words in human speech. Frequently it was reiterated by Jesus in sentences which, as translated, begin, "Verily, verily, I say unto you." It is the concluding word in almost all liturgical prayers, thus signifying "so be it." In Revelation 3:14, Jesus Himself is described as "the faithful and true witness" and the word "true" is the Greek Amen. The expression thus denotes the strongest asseveration known to man and is in fact an appeal to the truth inherent in the Deity.

**AMEN CORNER**, in London, at the west end of Paternoster Row, the point at which the monks, go-

ing in procession to St. Paul's on Corpus Christi Day, used to end their chanting of the PATERNOSTER with a concerted *Amen*.

**AMENORRHEA**, absence of the menses, or monthly flow of blood from the womb, which may be due to natural causes, such as pregnancy or advancing age. Other causes are shock, brought on by fright, fear or grief; diseases, such as diabetes, anemia, and tuberculosis; and also disorders of the glands of internal secretion, especially the thyroid and pituitary glands.

**AMERIA**, the modern Amelia, is an ancient town of Umbria in central Italy. It was the birthplace of Sextus Roscius Amerinus, defended by Cicero in a speech. Some of the original city walls, of polygonal limestone, still remain. A bishopric was founded here in the 4th century and in the 11th a vast cathedral was built, the campanile of which is still standing.

**AMERICA**, the land mass of the Western Hemisphere which, with the adjacent islands, has an area of about 16,000,000 sq. mi. It was named for AMERIGO VESPUCCI, an Italian navigator, and is also frequently called the New World because of its comparatively recent discovery and settlement. The waters surrounding the land consist of the Atlantic Ocean on the east, the Pacific on the west, the Arctic Ocean on the north, and the Antarctic Ocean on the south. The mainland, measuring from Boothia Felix to the southern extremity of Patagonia, has a length of about 8,700 mi. which is increased to 9,600 mi. by adding the spread out Canadian archipelago north of Hudson Bay and the island of Tierra del Fuego south of Patagonia. With its islands America reaches farther north and south than any land areas in the Eastern Hemisphere. Cape Morris Jesup in Peary Land at about 82° N. lat. comes within 450 mi. of the north pole and Cape Horn at about 56° S. lat. is within 2,350 mi. of the south pole. The extreme east and west positions of the mainland are Cape Pernambuco in Brazil at 34° 51' W. long. and Cape Prince of Wales, Alaska, at 168° W. long. The latter point reaches within 36 miles of the land mass of Asia.

America is divided into two continents, North America and South America, connected by the Isthmus of Panama. In shape each bears some resemblance to a triangle, the base being along the northern border and the apex at the southern end. Because of their different positions in relation to the Equator, their climates are reversed, the northern part of North America being polar and the northern part of South America tropical. The principal islands included in America are Greenland which is the second largest island in the world; the Canadian archipelago, including Baffin Land; Newfoundland; and the West Indies.

The physical features, considered broadly, are bold and well defined. On both continents a chain of high mountains extends north and south along the western margin: the Rockies in North America and the Andes in South America; and an older, comparatively low range occurs near the eastern coast: the Appalachians in North and the Eastern Highlands in South

America. In both instances a vast plain lies between. The highest elevation, which occurs in South America, is Mount Aconcagua, 23,080 ft., on the boundary between Chile and Argentine, and the lowest is Death Valley, 276 ft. below sea level, in California. The mean altitude for both continents is 1,300 ft. Neither continent has extensive desert regions, and both have immense forests and large rivers affording access far into the interior. The Mississippi-Missouri river system is the longest in the world, while the Amazon has the greatest volume and largest drainage basin. North America has the Great Lakes, the largest body of inland water in the world.

The political divisions, according to continents, are: In North America, Alaska, which is a territory of the United States; the Dominion of Canada, belonging to the British Empire; the United States proper, comprising 48 states; the republic of Mexico; and Central America consisting of six independent states and a British colony; South America consists of the United States of Brazil, the republics of Argentine, Chile, Paraguay, Uruguay, Bolivia, Peru, Ecuador, Colombia and Venezuela; and the colonies of British, French and Dutch Guiana. Of the islands, Greenland belongs to Denmark, Newfoundland is a dominion of the British Empire, and the West Indies are partly independent while some are dependencies of the United States and the British Empire.

The population of the entire New World is estimated at 246,400,000 people of which about 155,509,000 live in North America, about 80,856,000 in South America and 10,015,000 in the West Indies. In the United States and Canada representatives of the white races predominate, while in Mexico and in Central and South America the majority of the people are a mixture of white races with the native Indians. See also ARCHAEOLOGY, Prehistory of America.

**AMERICA, EXPLORATION OF.** Iceland had long been inhabited by a small colony of Irish monks, of the venerable monastic order of Culdees, when it was discovered by Norwegians in the latter half of the ninth century. In 872 Harald Haarfager attained supremacy in Norway and proceeded to abrogate many privileges of the nobles, numbers of whom emigrated. Some of the more adventurous, beginning in 874, came to Iceland. The next step toward the American mainland was the discovery of Greenland, accredited to a Norwegian named Gunnbjörn, about the beginning of the 10th century. On the strength of this account Eric the Red sailed from Iceland in 982, and spent three years in exploring the lower coasts of Greenland. He returned to Iceland to recruit colonists. Four years later Bjarni Heriulfsson, making a voyage from Norway to Greenland, was driven out of his course, and sighted new country; his ship followed the continental coast for several hundred miles, but no landing was made. In 1003 Leif Ericksson sailed for the new country, which he named Vinland, and in the following year returned to Greenland. Thorvald, his son, came to Vinland in 1005; and the Norseman made other voyages to the

New England shore before the idea of colonization was abandoned. In the meantime settlements had been made in Greenland which lasted, long after all contact was lost with Norway, into the 15th century.

The discoveries of the Norseman had perhaps been forgotten when Christopher Columbus, on Oct. 12, 1492, reached a coral island (probably Watling Island) in the Bahamas. But it has been ingeniously conjectured—without sufficient documentary proof having been made public—that Columbus had previously reached the New World as a member of the crew of a Danish fishing sloop. On his third voyage Columbus reached the continental mainland, Aug. 1, 1498, at a point on the northern coast of South America. Already, in the summer of 1497, John Cabot had coasted along the Gulf of St. Lawrence. In his voyage of 1498 he sailed, perhaps, as far south as South Carolina, if not farther; in any event, there is ample evidence that the southeastern shores of North America had been explored before 1502. Gaspar de Corte-Real made two notable voyages to Newfoundland and the Canadian shore in 1501 and 1502; already, it is likely, Norman and Breton fishermen were fishing off the Newfoundland Banks. Alonso de Hojeda, whose expedition included Juan de la Cosa, the famous pilot and cartographer, and Amerigo Vespucci, in whose honor the geographer Martin Waldseemüller christened the continent, coasted the whole breadth of British Guiana and Venezuela in 1499. Vicente Yañez Pinzon reached the eastern shore of Brazil on Jan. 20, 1500, and was first to explore South America below the equator. Diego de Lepe in the same year reached the hitherto undiscovered shores, below Cape St. Augustine on the Brazilian coast. In 1500-02 Rodrigo de Bastidas, with La Cosa, explored the northern coast of South America, filling the gap between Cape de La Vela, where Hojeda had turned homeward, and Columbus' discoveries near Panama. The Portuguese claim to Brazil was based upon the voyage of Pedro Alvarez Cabral in 1500, who sighted the coast near Porto Seguro on Apr. 21.

Sebastian de Ocampo, in 1508, circumnavigated Cuba. Four years later Ponce de Leon coasted along western Florida. Hernandez de Cordova discovered the peninsula of Yucatan in 1518; and his work was later followed up by Juan de Grijalva, who continued northward beyond Vera Cruz. In 1519 an expedition from Cuba, commanded by Alonzo de Pineda, followed the gulf coast from Florida to Vera Cruz; Hernando Cortes, in the same year, began the conquest of Mexico. Vasco Nuñez de Balboa marched westward from Darien and discovered the Pacific on Sept. 25, 1513. In Nov., 1521, Magellan entered the Pacific through the straits later named for him. The voyages of De Avila and Miño in 1522, Mendoza in 1532, and Alarcón in 1540 made known the western coast of Mexico and the Gulf of California. Meanwhile other Spaniards—Cabeza de Vaca, 1534-36, Friar Marcos in 1539, Francisco de Coronado, 1540-42, and Hernando de Soto in 1542 were adventuring into the great wilderness of the interior of North America. In

1524 Verrazano had commanded the first French expedition to the New World under government sanction, entering the country by way of the St. Lawrence. Later French explorers struck boldly into the heart of the continent (*see CANADA, HISTORY OF, Era of New France*). The inheritors of the continent, the English rested their claims upon the voyages of the Cabots until Sir Martin Frobisher, with Queen Elizabeth's patronage, made three expeditions, 1576-78, in search of the "northwest passage" to India, and reached Frobisher Bay and Hudson Strait. In 1578 Sir Francis Drake, having passed through the Straits of Magellan, followed the Pacific shores as far northward as latitude 48° N. John Davis, in the course of three voyages in quest of the northwest passage, 1585-87 reached Cumberland Sound and Baffin's Bay.

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**AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE**, a society organized in 1848 in accordance with a resolution adopted in Boston by the Association of American Geologists and Naturalists. It was incorporated in 1874 by an Act of General Court of Massachusetts. Its object is to promote intercourse among those who are cultivating science in different parts of America and to give more general impulse and systematic direction to scientific research. Its membership includes many eminent scholars in humanistic and social studies. An award of \$1000 is given annually to the author of the outstanding contribution to science presented at the annual meeting.

**AMERICAN BAR ASSOCIATION**, an association consisting in 1930 of some 28,667 members of the Bars of the various states and territories of the United States and the District of Columbia. It was founded in 1878. It meets annually at a time and place selected by its Executive Committee. These meetings have usually been in the United States, though two meetings have been held abroad, one at Montreal, Canada, in 1913, and one, a special 1924 meeting, in Europe, at which time sessions were held in London, Paris, Edinburgh and Dublin. The purposes of the Association are to "advance the science of jurisprudence, promote the administration of justice and uniformity of legislation and of judicial decision throughout the nation, uphold the honor of the profession of the law, and encourage cordial intercourse among the members of the American Bar." The headquarters of the Association are at 1140 North Dearborn Street, Chicago, Illinois. The Association now embraces seven sections which are known as the Conference of Bar Association Delegates; Criminal Law and Criminology; Judicial; Legal Education and Admission to the Bar; Mineral Law; Patent, Trade Mark and Copyright Law; and Public Utility Law. These sections, the numerous committees of the Association and the allied National Conference of Commissioners on Uniform State Laws which ordinarily



meets at the same place and immediately before the meeting of the Association, have done much to promote the objects of the organization as set forth above. *See also BAR.*

C. M. U.

#### AMERICAN COLLEGE OF PHYSICIANS.

*See MEDICAL ORGANIZATIONS.*

#### AMERICAN COLLEGE OF RADIOLOGY.

*See MEDICAL ORGANIZATIONS.*

**AMERICAN COLLEGE OF SURGEONS.** *See MEDICAL ORGANIZATIONS.*

**AMERICAN COUNCIL ON EDUCATION**, a non-profit-making, central organization established in 1918 in which the great national educational associations are represented. In 1931 there were 25 national associations, as constituent members, 23 associate members and 256 institutional members. The original activities of the council lay mainly in the field of university and college work and allied educational fields; but the scope of the organization has steadily broadened to include the study of American education and American educational policy as a whole. Some of the special problems studied have been modern foreign language teaching, personnel methods, educational finance and objective testing. Much emphasis has been laid on analysis of Federal relations to the school system, and the council is working with the Federal Administration to determine a constructive policy. Grants for special investigations have been received from the JULIUS ROSENWALD FUND, Carnegie Foundation for Advancement of Teaching (*see CARNEGIE TRUSTS*), GENERAL EDUCATION BOARD and JOHN D. ROCKEFELLER, JR.

**AMERICAN DRAMA.** *See AMERICAN THEATER AND DRAMA, THE.*

**AMERICAN FEDERATION OF LABOR**, an alliance of trade unions (*see LABOR ORGANIZATIONS*) which includes in its membership most of the national unions in the United States. Craft autonomy with loose federation for conduct of intercraft union affairs is the basis of its structure. It is without authority except that delegated to it by its affiliated organizations. Within the federation are affiliated four departments, 49 state federations, 106 national or international unions, 795 central bodies and 523 local trades and federal labor unions.

The departments (building trades, metal trades, railway employees and union label trades) are federations of allied national and international organizations, created to act as clearing houses for difficulties arising between the organizations. Their functions include encouragement and formation of local organizations, adjustment of disputes and settlement of jurisdictional questions.

The state federations (48 states and Porto Rico) are delegate bodies composed of representatives from affiliated national and international, local and city central bodies within the state. Their functions are chiefly propagandist and the encouragement of favorable legislation.

The national or international unions are organizations bringing together under one jurisdiction all local

unions in one craft or industry within the United States, Canada and sometimes Mexico. They are the powerful units of which the Federation is an alliance. They create their own locals, maintain organizers, control charters, discipline and render financial assistance to constituent locals.

Central labor unions or city centrals are delegate bodies representing all national, international and local unions in a city or town.

Affiliated directly with the American Federation of Labor are 383 organized local trade and federal labor unions, chartered and governed directly by the federation. Local trade unions are usually composed of workers in a trade which is not organized nationally or the national organization of which is not affiliated with the Federation. When they become numerous enough they form the nucleus of a national union. Federal labor unions are composed chiefly of unskilled workers in unclassified occupations. They include any number of crafts.

Historically, there have been several attempts at trade union alliances, but only the federation has survived. Its chief rival, the Knights of Labor, was supplanted by the more practical Federation. It functions through its annual convention, a delegate body which elects annually an executive council consisting of a president, eight vice-presidents, treasurer and secretary. The executive council which carries on the executive and legislative work of the federation, directs the work of organization, watches legislation, authorizes strike benefits, grants charters and makes rules not in conflict with the constitution of the federation or its affiliated unions. All affiliated bodies are represented in the convention, but the bulk of the voting power rests with the 106 national and international bodies who control the policies of the federation. Its revenue is acquired from dues and assessments.

In 1931 approximately four-fifths of the membership in the American labor movement was within the ranks of the federation, the total membership of which was approximately 3,500,000. The most important unions outside the federation were the four railroad brotherhoods, the AMALGAMATED CLOTHING WORKERS, the Amalgamated Textile Workers and the INDUSTRIAL WORKERS OF THE WORLD. Although their jurisdictional claims do not seriously conflict, repeated efforts toward affiliation of the railroad brotherhoods have failed. The other organizations are so-called dual unions, their jurisdiction conflicting with that of organizations already affiliated with the federation.

The general object of the federation is the betterment of the conditions of workers in all fields of human activity. According to its constitution, it aims to encourage the formation of unions, to promote use of the union label, to secure favorable legislation, to aid and encourage the labor press and to influence public opinion by peaceful and legal methods.

Throughout its existence, the federation has followed a policy of nonpartisan political action, its political activities being restricted to advisory service to its affiliated organizations such as reporting upon

the labor records of political candidates. This policy has enabled the federation to avoid the danger of splits over partisan political issues.

The president of the federation for almost the whole of the period from its founding in 1881 as the Federation of Trade and Labor Unions until his death in 1924 was SAMUEL GOMPERS, one of the most picturesque figures of the American labor movement. His successor is WILLIAM GREEN. The federation has headquarters in its own building in Washington, D. C. P. F. B.

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**AMERICAN GEOGRAPHICAL SOCIETY**, organized in 1852 and incorporated in 1854 as American Geographical and Statistical Society. The name was changed to its present form in 1871. The society collects and disseminates geographical information, maintains in New York a building where accurate information on every part of the globe may be obtained, and encourages exploring expeditions which promise to result in valuable discoveries in geography and related sciences. Medals are awarded for geographical discoveries, distinguished research and scientific achievement in geography. ROBERT E. PEARY, ROALD AMUNDSEN, VILHJALMUR STEFANSSON and THEODORE ROOSEVELT were among those to receive these medals.

**AMERICAN INDIANS.** ACOMA, ALEUT, ALGONKIAN, APACHE, APALACHEE, ARAPAHO, ATHAPASCAN, ATTIWENDARONK, AYMARA, AZTEC, BANNOCK, BEAVER, BELLABELLA, BLACKFOOT, CADDO, CAHUILLA, CATAWBA, CAYUGA, CHEROKEE, CHEYENNE, CHINOOK, CREE, CREEK, CROW, DAKOTA, DELAWARE, ESKIMO, FIVE NATIONS, HOPI, IROQUOIS, KUTENAI, MAHICAN, MAIDU, MARIPOSAN, MAYA, MUSKHOGEAN, NAVAHO, NEZ PERCÉ, SEMINOLE, SIOUAN, ZAPOTEC, ZUNI.

**AMERICAN INDIANS, LANGUAGES OF.** See MEXICAN AND CENTRAL AMERICAN INDIANS, LANGUAGES OF; NORTH AMERICAN INDIAN, LANGUAGES OF; SOUTH AMERICAN AND ANTILLEAN INDIANS, LANGUAGES OF.

**AMERICANIZATION**, a term used to describe the process of teaching English to and inculcating principles of good citizenship in those of foreign birth. Though steps in this direction had been taken long before 1914, it was the World War which brought about what is generally known as the Americanization Movement. The breaking out of war revealed clearly the sympathetic leanings of foreigners toward their respective countries, and the dangers of divided allegiance if not actual disloyalty to America were quickly realized. Patriotic groups broadcast pamphlets to warn Americans of the imminent danger of having such a large element of its population unable to read or speak English, thus relying largely on newspapers in foreign languages or other foreigners for information concerning the War, and ignorant of even the fundamentals of citizenship. The whole country was aroused to action. Schools for those of

foreign birth were opened by city, state and Federal Government. Classes were organized by the Y.M.C.A., the Y.W.C.A., churches, factories and other groups. English, American history and civics were the chief subjects taught, and stress was laid on the foreigner becoming an American citizen. Community centers were established especially for women with families so that they could be taught the English language and learn to adjust themselves to American customs.

At first the Americanization Movement, based on fear and natural suspicion of the foreign element in the country, was bent on changing the foreigner into an American. Since the close of the War, there has been a slow but steady transformation in this earlier attitude, and it is now realized that the better way is to develop a mutual understanding and trust between the foreigner and American without trying to destroy the foreigner's own characteristics. Less emphasis is laid also on forcing the foreigner to become a citizen. Since 1925 there has been a very definite drifting away from the Americanization Movement as such toward the development of a program of ADULT EDUCATION for those of foreign birth, which shall be made a part of the public school system but especially adapted to their needs. In these evening schools and day classes they will be instructed in English, prepared for naturalization and citizenship and helped to adjust themselves to the customs of their new country. With this new trend, even the term Americanization is fast falling into disfavor. M. R.

See R. Hill, "From America to Adult Education," in *Survey*, June 15, 1929; United States Bureau of Education *Bulletin*, 1923, Nos. 30 and 31.

**AMERICAN LANDSCAPE PAINTING.** See LANDSCAPE PAINTING IN AMERICA.

**AMERICAN LAW**, a term loosely used to designate, as contrasted with the system of law in force in another country, the law in force in the U.S. The implication of unity or uniformity is, generally speaking, false. Only the Federal laws which issue directly or indirectly from a constitution creating a central government of delegated powers may be said to be applicable throughout the nation.

The transplantation of the English common law to America took part piecemeal as one by one colonies were organized. Differences in local American conceptions of the common law and differences as to the degree in which English law was received on this side of the water are noticeable from the first recorded legal opinions. According to one theory, the common law and statutes in force in England at the time of the organization of any given colony became effective within the colony in the absence of specific provisions to the contrary. According to another theory, only that part of English law was received which was consistent with the conditions and political ideals received within the colony concerned. The traditions of the common law took root after a brief but decisive struggle with certain civil law influences, and have become the dominating legal

traditions of the United States with the exception of Louisiana where the basic law is derived with much common law modification from the *Code Napoleon* with a few lingering traditions of Spanish law, and the exception that in the states acquired from Mexico there are still tenacious traces of the civil law, mainly in the field of property. In the march of population from the east coast to the west, frontier customs to some extent modified the common law, while innumerable statutes, state and Federal, have served to create an American system varying in the forty-eight states.

After a period of central governmental administration, under Articles of Confederation which demonstrably entrusted too little power to the central authorities, the Constitution which furnishes the outline of the present form of government was adopted in 1789. Under this Constitution, which has been broadly interpreted—though subject to the doctrine that the Federal government is one of delegated powers and, therefore, has only those powers which are expressly granted to it and those which are appropriate and proper for carrying out those powers—a strong central government has been built up. While theoretically each state is sovereign within the field of government ascribed to it, the national consciousness of the American people has gradually overcome the theory of states' rights to a very large degree. The theory with respect to state governments is that they have all powers which have not been delegated to the Federal government nor denied by a constitution, state or Federal, to the state government or reserved to the people. The state governments are organized on the same general plan as the Federal government, being divided into three departments, executive, legislative, and judicial. In many of them, as under the Federal government, certain commissions and other administrative bodies have sprung up to carry on the routine work which is too voluminous or too technical for the legislative and executive branches of the government to handle. The Federal Constitution has been amended nineteen times and its changes have extended the powers of the national government to certain fields of public and private law which, for practical reasons or reasons of expedience, could not be satisfactorily administered by the several states.

The far greater part of the fields of law has remained subject entirely to state control since the formation of the present federated union; and, as recognized and enforced in the states, the rules, principles and standards of law (whether of common law or statutory origin), vary from almost the original rendering to quite the opposite. A considerable similarity of laws has been brought about, however, as the result of legislative and judicial borrowing, which is more and more facilitated by improvement of communication and transportation, and the work of the American Bar Association, the National Conference of the Commissioners on Uniform State Laws, and the American Law Institute.

The National Conference of Commissioners on

Uniform State Laws was suggested by the appointment of a special committee on Uniform State Laws of the American Bar Association in 1889, and the first annual meeting was held in August, 1892. Since 1912 all of the states, territories, the District of Columbia, Porto Rico, and the Philippine Islands have been officially represented at the meetings of the Conference. Its object is, "to promote uniformity in state law on all subjects where uniformity is deemed desirable and practicable." The Conference has drafted, approved, and now recommends for adoption some forty-six acts and it has approved a few proposed acts drafted by other organizations. Many of its uniform acts have been widely adopted with little change and nearly every one of them has been enacted by one or more states.

The American Law Institute was organized in 1923 in response to a demand which had been strong and rapidly growing among judges, teachers of law, and the practicing Bar for some years previously. The objects of the Institute are, "to promote the clarification and simplification of the law and its better adaptation to social needs, to secure the better administration of justice and to encourage and carry on scholarly and scientific legal work." With headquarters located at Philadelphia, and with a large corps of workers recruited from the ablest judges, teachers and law practitioners in America, the Law Institute has completed and now recommends for adoption a Code of Criminal Procedure and it has made great progress in restatements of the Law of Agency, Business Associations, Conflict of Laws, Contracts, Torts, Trusts, and Property. Preliminary work is being done in the field of administration of the Criminal Law. While it is not intended that the results of the studies shall be adopted as statutes, it is the hope and intention of the Institute that these restatements of the common law, as usually declared and enforced in America or as selected and advocated by the able scholars who are working upon the several subjects, shall from time to time be cited in and followed by the courts so that their very existence will operate to bring about a uniformity of law. *See also COMMON LAW; ANGLO-SAXON LAW; CONSTITUTION; ENGLISH LAW; STATUTE.* C. M. U.

**AMERICAN LEGION**, an organization composed of men who served honorably with the American armed forces during the World War or who, while American citizens, served in the forces of an allied power. It originated in Paris in Mar., 1919, at a meeting of American officers and enlisted men where a committee of 15 was appointed to organize the order in the United States. In May 1919, a preliminary convention was held at St. Louis and a constitution adopted. The purposes of the organization were declared to be to uphold and defend the Constitution of the United States; to maintain law and order; to foster and perpetuate 100% Americanism; to preserve the memories and incidents of association in the World War; to inculcate a sense of individual obligation to the community, state and nation; to com-

bat autocracy of either the classes or masses; to make right the master of might; to promote peace and good will; to safeguard and transmit to posterity the principles of justice, freedom and democracy; and to sanctify the comradeship of the war by mutual helpfulness.

The society was incorporated by an act of Congress, Sept. 16, 1919, and the first regular convention was held at Minneapolis in November of that year. Since then conventions have been held annually. The executive officers are a national commander, five vice-commanders, a national adjutant, treasurer, judge advocate and historian. Local units are known as posts and are grouped into departments of which there is one for each state and territory including Alaska, the Canal Zone, and Philippine Islands. There are also branches in Canada, Mexico and continental Europe. The membership in 1931 totaled 1,046,009.

**AMERICAN LITERATURE.** Unlike the ancient literatures of Europe, American literature derives directly from no early people expressing itself in saga and folk-lore. To penetrate behind the settlers of Plymouth and Jamestown is to discover merely the primitive writings of Indian or Aztec, uninfluential until letters had reached a moderate stage of sophistication as in, say, the poetry of Longfellow. Its origins lay in England, whose language, customs and ideals set an ineffaceable stamp upon this transplanted civilization. This seal remained, but the student of American letters notices, almost within the first century, the restless desire and need of cleaving in writing, as in the more practical activities of the republic, to the American soil. This tendency is evident not only in "nationalism" in literature, in respectful arresting in books of what Cooper called "American things," in increased self-sufficiency of critical standards, but chiefly, after the Civil War, in the creation of prose and poetry in debt hardly at all to Europe, but to the peculiar conditions of American life. As Daniel Boone or Abraham Lincoln are indigenous, so are the frontier epics of "Mark Twain" or other writings depicting "The Unshorn Fields, boundless and beautiful, for which the speech of England has no name."

Whether or not America would have been wiser, as James Russell Lowell thought, to cling only to the established Anglo-Saxon traditions of the acknowledged masters is irrelevant here; the battle between the gifted imitator and the bold original has been as bitter as that between urban-dwellers and agrarians, of which it is a counterpart. The point is that the history of American literature records, apart from minor shifting influences, this struggle. Whatever is great in it results from the fervor with which a Poe or a Whitman adhered to one or the other of these convictions. Such a conflict will be apparent even in this brief essay.

**Seventeenth Century.** The influence of buckram English prose of the 17th century is visible in even the untutored writings of the early Southern colonists. CAPTAIN JOHN SMITH (1580?-1631) describes

Pocahontas, or his fight with the Indian in which he used one redskin as a "barricado" against the others, with energy and spirit. This explorer's *Map of Virginia*, 1612, or his *Description of New England*, 1616, interest the modern reader quite as much as the account of the wreck at the Bermudas by the gentleman, William Strachey, or the translation of Ovid's *Metamorphoses* by the scholar, GEORGE SANDYS (1577-1644). These, like the later southern colonials, WILLIAM BYRD (1674-1744), Hugh Jones (1669-1760), Robert Beverley (1675?-1716), or William Stith (1689-1755), reflect the freer life of Virginia and the Carolinas, though this liberalism has been much exaggerated to make an effective contrast to the solemn orthodoxy of New England. Of this popular if inexact notion of the early South, William Byrd is, perhaps, except for antiquarians, the most interesting incarnation. Aristocratic Virginian, reader of *The Beggar's Opera*, railer at New Englanders for their piety and at North Carolinians for their crude "Bombo," or rum and water, he set down in the racy prose of his *History of the Dividing Line* the joys and boredom of an English gentleman living in 17th century Virginia.

The contemporaries of these men, the letter-writers, historians and, occasionally, the poets of the Pilgrims and the Puritans lived in an intellectual air, like that of their sea- and Indian-girt frontiers, colder, but also more bracing. *The History of Plymouth Plantation*, by WILLIAM BRADFORD (1588-1657), is a chronicle of events, of Indian horrors, and of celestial interferences aiding these stern men in building their body civil-politic. Flinty still, but more eloquent, JOHN WINTHROP carries on in his *History of New England* the moving tale of hardship and idealism, even as *The New English Canaan* of Thomas Morton (?-1646), banished from the colony for his levity, shows the slender place in this fellowship for maypoles, rhymes and dancing. The Massachusetts men were, as they calmly described themselves, clearers of wildernesses, founders of towns, preachers of the Word. Fighters and scholars too, many of them, they cherished few illusions concerning the difficulties of their covenant in this new land, and in nearly every page of their rugged writing may be read their acceptance of the facts that neither this world's goods, so dear to Byrd, nor peace, nor God Himself were to be had lightly. Jesus Christ, remarked one Divine, Thomas Shepard, can not be had "with a wet finger."

Their stout warfare against the Indian and their other adversities is clearly if not elegantly described by their historians: Captain John Mason (1600?-72) in his *Brief History of the Pequot War*; by Edward Johnson (1599-1672), in his *History of New England*; by Nathaniel Morton (1613-1685), in *New England's Memorial*; and, bridging the next century, by William Hubbard, Benjamin Church, John Williams, Thomas Prince and Thomas Hutchinson. Stiff and tedious documents these often are, yet always informative, and often from their stark simplicity even dramatic, as in Church's account of the killing of King Philip or

Mary Rowlandson's recital of her captivity, or Williams's horror as he saw the painted faces at his doorway. One returns, however, in these cuneiforms of American literature to the prose and poetry most typical of the inner life of these Puritan writers, omitting even the controversial pamphlets, such as the stinging satire of NATHANIEL WARD (1579?-1652), *The Simple Cobbler of Aggawamm*.

For the core of early New England literature lies in its religious writings. In contrast to the secular literature of Virginia these crabbed pages are illumined by gleams of light and darkness from the other worlds never far absent from their writers' thoughts. Their mediums were the sermon, the pamphlet, the tract, and occasionally verse, whose distichs, thought Michael Wigglesworth, were composed directly under the eye of God. The illustrious John Cotton (1585-1652), with his *Brief Exposition upon Ecclesiastes*, and the catechism whose title has aroused in later generations some irreverent mirth, *Spiritual Milk for Boston's Babes*; Thomas Hooker, the founder of Hartford, Conn., author of *The Soul's Vocation*; ROGER WILLIAMS, the father of ever-heretical Rhode Island—all repeat, with conservative or radical variations seemingly unimportant today, the same strain: the sovereignty of God and the puny efforts of man to achieve redemption.

Poetry, too, among these contemporaries of John Milton, among whom it has been said few or no copies of Shakespeare were to be found, was also the handmaiden of religion. *The New England Primer* and *The Bay Psalm Book*, 1640, merely jingled together phrases of Holy Writ and John Calvin's theology, and the widely-current *Day of Doom*, 1622, by MICHAEL WIGGLESWORTH (1631-1705), celebrated, after a searing picture of the day of the last trumpet, the mercies of Christ in allotting to unbaptized children "the easiest room in Hell." Hawthorne admired the sincerity and intensity of this jagged poem, and drew a moving picture of a Puritan family listening by their fireside to its trip-hammer theology—the stern father, the pale, wistful mother, the fearful children, many of whom were compelled to learn this doggerel by heart. A sweeter spirit, if not less fervent, breathes through the poetry of Mistress ANNE BRADSTREET (1612-72), daughter and wife to governors of Massachusetts. Repeating the eccentricities of diction of 17th century English poets and diverted from her genuine intellectual interests by ill-health and solicitude for her eight children, she nevertheless expressed in *The Tenth Muse lately sprung up in America*, 1650, and especially in *Contemplations* that sense of beauty which, though suppressed by the rigors of their life, lurked in the Puritan soul, escaping in the lift of a church-spire, a graceful chair, or in such artless documents as the letters between John and Margaret Winthrop.

In the latter part of the 17th century these qualities of intellect and piety seemed concentrated in the Puritan dynasty of the Mathers, Increase (1639-1723), and his son, COTTON MATHER (1663-1728), both dominant

men in the religious and secular life of the colony. Increase Mather, Moderator of the "Reforming Synod" of its churches, president of Harvard College and critic of the faults of his people, was a sounder leader than his son, the introspective, capricious, ecstatic author of the *Magnalia Christi Americana*, or *The Ecclesiastical History of New England*, 1702. This monument of his enormous labor, made possible perhaps by the cordial inscription in his study to visitors "Be Brief," not only suggests his outstripping of his more practical father (in 400 volumes to 150) in pure scholarship, but will remain a source book for historians, antiquaries, scholars and men of letters. Longfellow's plunder from it is well known. To learn of divines, governors, educators, wars, or even of the pedantries and fanaticisms which cramped the early literature of America, one must still turn to Cotton Mather.

**Eighteenth Century.** Before Mather's death in 1728 the new liberal thought of the growing colonies had already thrown its light over men skeptical of the Puritans' rigid scheme of the universe. Benjamin Franklin, though born in Boston, was smiling slyly at the heat of Calvinists, and was asking himself those sane questions whose answers are recorded in his *Autobiography*, begun in 1771. Deism, democracy and the gospel of getting-on were subverting these pyramided metaphysics of the saints of New England. Yet against the deluge one mighty bulwark still stood firm well into the 18th century. One may well omit such lesser theologians and writers as John Wise (1652-1725), Jonathan Mayhew (1720-66) or even the gay, royalist churchman, Mather Byles, and the candid Peter Folger, to dwell briefly on the philosopher and theologian, JONATHAN EDWARDS (1703-58), the apotheosis of all that was good in Puritanism, whose creed was crumbling, but whose attitude toward life was to color American thought for generations.

Edwards, born in East Windsor, Conn., and graduated from Yale College in 1720, betrayed early the quality of his mystical and, granted the premises of his pre-scientific and theological epoch, logical mind. At 14 he read Locke, and in a few youthful papers demonstrated his capacity for tracking down into the unknown darkness the roots of human thought; *Of Being* is still a tough hurdle for the amateur philosophical runner. In 1727 Edwards became pastor of the church in Northampton, and aside from the *Great Awakening*, his stormy dismissal from his pulpit in 1750, his service with the Indians and his brief presidency of Princeton College, little in Edwards's quiet, scholarly career corresponds with his intense inner life of mental effort. In his sermons, notably *Sinners in the Hands of an Angry God*, during the pronouncement of which men and women begged for mercy; in his *Personal Narrative*; in his *Treatise on the Freedom of the Will*, 1754, which commanded respect abroad; and in his life as preacher and writer, may be perceived his holiness and depth of intellect. Apart from Franklin, he may defensibly be called the

greatest American thinker of the 18th century. Yet Puritanism was already doomed by the surging, buoyant thought for which BENJAMIN FRANKLIN stood, by the middle of the century the idol of his forward-looking countrymen. His story, too often told to be repeated here, was their story, glorified. This chandler's son, this printer, this imitator of practical thinkers and writers, this master of applied science, so typical of the American which has produced no Newton, but many Edisons, this bold diplomat who wore his coonskin cap before kings, and foresaw, during the Revolution and postwar feuds of jealous states, the western empire, would be amused at being celebrated in an article on literature, which he took in his stride as a minor craft. Yet his informative, honest *Autobiography*, his utilitarian precepts in *Poor Richard's Almanac*, and his *Bagatelles*, so graceful and so replete with this world's gospel, have rendered him indisputably a man of letters. If the sun reminded him not of heavenly hosts, as in the case of Edwards, but of a bright new guinea, and if lightning inspired in him not awe, but the need of a lightning rod, he was none the less a statesman, moving easily among his great contemporaries of the 18th century in England and France, and recording this age in immemorial fashion.

Meanwhile the shadows of the Revolution settled down upon America, turning writers to the oration, the political pamphlet and ephemeral verse satire. The drama, already dignified by the talented THOMAS GODFREY (1736-63) gained new impetus in stage-versions of patriot problems, but the writings, however earnest and trenchant, of James Otis, the Adamses, Alexander Hamilton, John Dickinson, Thomas Jefferson and their kind must be included in the category of literature only with reservations. Paine's *Common Sense*, 1776, *The Crisis*, 1776, and *The Rights of Man*, 1794, were peaks in the emancipated thought of a country which was militant against kings and theocracies. THOMAS PAINE was neither "a dirty little atheist," as Roosevelt called him, nor the greatest of the deists, as his followers believed, but his fearless expression of what many Americans were thinking concerning government and religion made him a memorable contributor to the scanty literature of the Revolution.

At least he thought in larger principles than the Loyalist satirists, such as JONATHAN ODELL (1737-1818), or the chauvinistic poets who flourished during and immediately after the war, such as Timothy Dwight (1752-1817) or Joel Barlow (1754-1812) and others of the "Hartford Wits," who, as a group, seldom strayed from the complacent valleys of Federalism and conservative, English literary criteria. At the close of war, another of this coterie, John Trumbull (1750-1831), was famous as the author of a witty anti-Tory satire, *McFingal*; Dwight had finished his epic, *The Conquest of Canaan*, 1785, and had begun his turgid *Greenfield Hill*, 1794; Barlow, who had hardly commenced his romantic career ending amidst Napoleon's retreat from Moscow, was still to

write his nationalistic heroic poem, *The Columbiad*, 1807. And David Humphreys, white-wigged and conspicuous in the portraits of General Washington's staff, was preparing his pompous lines in the manner of Pope on the industries and agriculture of America. If these were indeed the "wits" what were other Americans in these days, so troubled for literature?

It should be frankly admitted that with a few exceptions the period at the edge of the 19th century was a literary desert. Yet these few deserve attention, as do even this Hartford group, who at least encouraged literature. Thus the dramatist, Mercy Warren (1728-1814), has been found worthy of a deft modern biography, and William Dunlap (1766-1839), playwright and theater-manager, deserves more study than he has received. The novel, that bane to the Puritans, was developing, and even escaped the shackles of the sentimental tradition in Hugh Henry Brackenridge (1748-1816), whose *Modern Chivalry* is a crude, robust satire on the new democracy. Fiction even attained dignity and passion in such tales of the supernatural, as *Wieland*, 1798, by CHARLES BROCKDEN BROWN, a Philadelphia editor and lover of literature for its own sake. Many influences meet in Brown—the Gothic romance, the American frontier, democratic reforms and contemporary issues—to form a novelist who will always occupy a significant place in the history of American fiction.

Yet in this intransigent period one thinks most gratefully of three writers, each as distinct in his flavor as the unique types of men bred by this bustling democracy. One was "that rascal Freneau," as Washington called him, PHILIP FRENEAU (1752-1832), lover of the sea, author of scathing anti-Federalist satire, and, most happily, a rose in the desert in his delicate gift, when not torn by the passions of his era, for the imaginative lyric. Freneau's poems on politics and the Revolution make a stout volume, but one would cancel them all for more lovely lines such as those in *The Wild Honeysuckle* or *The Indian Burying Ground*. Far different, but of the same integrity of natural talents was JOHN WOOLMAN (1720-72), the Quaker diarist whose words, Whittier thought, breathed sweetness in every syllable; and Hector St. John de Crèvecoeur, hating hypocritical patriots, loyal to his king, and loving America between 1754 and 1782. "What is an American?" he asks, half-sadly, caught in this civil war. He could only describe her fondly in *Letters from an American Farmer*, 1782, and *Sketches of Eighteenth Century America*, 1925, her beauty in Southern woodlands or in the snowstorms of the northern winter, her cruelty as his pioneer woman rides through the wilderness after the Wyoming Massacre.

**Nineteenth Century.** Now, as the republic took solid form, flinging its outposts ever farther west and south, strengthening its credit as a nation by the War of 1812, by the purchase of vast domains, by huge enterprises in the Northwest, defining its principles in finance and industry, literature became among small groups, another, if minor, ideal of the nation.



In the larger cities where older families and prosperous merchants turned to European books, had grown up a society more sophisticated, more thoughtful and capable even of satire upon themselves. In such a milieu, in New York of the first decade of the century, grew up WASHINGTON IRVING (1783-1859), laughing genially at the mannerisms, past and present, of his fellow-townsmen, in *Salmagundi*, 1807, and in *Diedrich Knickerbocker's History of New York*, 1809. Cultivated by study of the Elizabethan and 18th century English writers and by an early sojourn abroad, sensitive in taste, and an opportunist in the selection of his subjects, Irving pleased both English and American readers, the former by his adulation of the established traditions of Europe, the latter by his realization in personality and writing of an ideal of the epoch among the conservative—that of gentleman. *The Sketch Book*, 1819, *Brucebridge Hall*, 1822, *The Alhambra*, 1832, and other romantic versions of the past of Spain, where Irving twice sojourned for long periods, repeated in finished prose the lore of the parent continent. In the last named year Irving suavely adapted his method to American themes (*A Tour on the Prairies*, 1832; *Astoria*, 1836, *The Adventures of Captain Boneville, U.S.A.*, 1837) and concluded at "Sunnyside," on the Hudson, a career which JAMES FENIMORE COOPER (1789-1851) thought supine, but which was blessed by the affection of nearly all Americans.

Cooper himself associated, like Irving, James Kirke Paulding, Fitz-Greene Halleck and Joseph Rodman Drake, with New York, was a truculent, warm-hearted patriot whose aristocratic tastes and democratic principles warred fiercely within himself and in his country, where until the last few years his robust genius has been clouded by animosities, roused by his bold and sincere principles. Entered upon his career of writer by accident, he poured out novel after novel doomed to oblivion along with the contemporary issues they debated. Only when his power was diverted to the thrilling narrative on sea or frontier was he that great Cooper hailed by Balzac. Then did he become the creator of one of the unique characters in all fiction, Leatherstocking, known to readers in every language (*The Spy*, 1821; *The Pioneers*, 1823; *The Last of the Mohicans*, 1826; *The Prairie*, 1827; *The Pathfinder*, 1840; *The Deerslayer*, 1841). Beside him another Knickerbocker, by adoption, the poet WILLIAM CULLEN BRYANT (1794-1878) seems cold in his slender output of polished verse. A New England lawyer who became editor of the *New York Evening Post*, Bryant retained from the time of his boyish poem, *Thanatopsis*, 1817, throughout his long career as a journalist the inner moods of an enlightened and belated Puritan. His was the theme of the Psalmist, melancholy in the face of man's mutability and death, but he sang also man's dignity as a child of the Universal Creator. So Bryant wrote in *The Ages*, in *The Past* and in *To a Waterfowl*, but in *The Yellow Violet* or *The Fringed Gentian* he pointed the way for those who would

later sing of flowers, trees and hills of their own country, scenes almost invisible to those early Puritan poets who saw the new land through their longings for the fens of Lincolnshire.

Others throughout the length of the eastern seaboard and even beyond, were now writing: Samuel Woodworth, in *The Old Oaken Bucket*; David Crockett, of Tennessee; John Howard Payne, in *Home Sweet Home*; learned James Gates Percival, in *Seneca Lake* and *The Coral Grove*; and "jaunty Nat Willis," of life in Europe, a theme of which this generation could not have enough. All these, and even the great Knickerbockers, however, sound faint beside the clear, brave voices from New England in the '30's and '40's. The natural resurgents of the deeper culture of the Puritans of two centuries earlier spoke of the American society in which they moved, fearlessly, as did HENRY DAVID THOREAU (1817-62) in *Walden*, 1854, and *Of Civil Disobedience*, or contemplatively and retrospectively, as did NATHANIEL HAWTHORNE (1804-64) in *The Scarlet Letter*, 1850, *The House of the Seven Gables*, 1851, and *The Blithedale Romance*, 1852. More than this, they took sides, founding Utopian communities, supporting feminism (see FULLER, MARGARET), championing slavery through the fiery verse of JOHN GREENLEAF WHITTIER (1807-1892), or, with JAMES RUSSELL LOWELL (1819-1891), they enlisted under the ægis of every liberal cause. Thus they strove for a hearing with Americans who were ever more and more becoming the true sons of Benjamin Franklin.

Until the drums of the Civil War, and afterwards, these New Englanders fought; many of their writings have become social documents. Yet their claim to remembrance rests upon more enduring foundations. If Hawthorne was a surgeon whose merciless scalpel probed the Puritan mind, he was also an artist, painting in his somber, reposeful style an undreamed-of beauty in peculiarly American concepts of life. Thoreau, skilled in the classics as well as Indian arrow-heads, showed the common pickerel-pond, the Merrimac River, or Cape Cod in the light, blinding to a conventional American literature, of man's attitude toward Nature and God. Their achievement, however ridiculed by modern writers, was to be the first to view American life from fixed points of culture and with some comprehension of the best that has been thought and said in the world.

Scholars such as George Ticknor, historians such as George Bancroft, William Hickling Prescott, and Francis Parkman preserved this perspective. HENRY WADSWORTH LONGFELLOW (1807-82), by his scholarship and poetry on European subjects unfastened the gates of this culture to masses of Americans, a superficial culture, it is true, but conveying intimations to thousands of a world beyond that of Jacksonian caucuses and fur-traders' prices. Through the association of these writers in university, club, and cultivated home, this enriched life was sweetened by conversation and the arts, by music, and by wit such as that of OLIVER WENDELL HOLMES (1809-94), a true

cosmopolite, however much he declared Boston to be "the hub of the solar system." In Lowell indeed is reflected not, as in the Knickerbocker group, the issues of Pro-French, British, or ward politics, but the conflicts of the intellectual world; in him is mirrored the struggle between science and religion. Even in the poorly educated Whittier ran deep the silent currents of the Quaker faith, so akin to man's nobler conceptions of his destiny and God.

Weaving this tangled skein of religion, history, ethics, politics, literature and social thought into one clear strand stood RALPH WALDO EMERSON (1803-82), integral with each, but viewing all with a calm detachment. Six of his direct ancestors had been ministers; his was the boyhood of a saint. Yet by 1836 he had relinquished the faith of his fathers for a conception of life which owed much to the Greek neoplatonists, to the German mystics through Coleridge and Carlyle, and to the buoyant optimism of a region which had accepted Unitarianism in place of Calvinism, and which shared the general American desire for a religion commensurate with democratic principles. Emerson himself denied that he possessed a philosophy capable of synthesis. One may only mention his gospels of the sacredness of the human soul, the nearness of God to the soul, and the sufficiency of Nature as an interpreter of God to the soul; these tenets ramify in sentences which Emerson called hard repellent particles into a score of doctrines on prayer, travel, history, politics, manners and even gifts. The basis of Emerson's philosophy is transcendental; it is subject to data beyond and behind the evidence of the sense. Half-seer, half-Yankee, as Lowell declared, he has achieved his hold upon his countrymen, less from his ability to speak of "the currents of Universal Being" or the "transparent eyeball," than from his skill in bringing his manna down from Heaven in the form of home-baked bread. His aphorisms, "Trust thyself," "The sun shines to-day also," "Hitch your wagon to a star" are crescent points in philosophical thinking common to the Orient and Occident, but these maxims, denuded of context, glib on the lips of laymen, or printed on calendars or railway placards, are still adequate slogans for Democrats who never read a page of the azure-colored pamphlet, *Nature*, 1836.

This rhapsody of self-communion, with its motto from Plotinus, was Emerson's first book, and contains the essentials of his thought, expanded later into the essays, such as *Self-Reliance*, *Compensation*, *The Over-Soul*, *Friendship*. For the most part, Emerson, now read probably more widely than any other American of his era, whether in France or in Japan, addresses the individual; he is, to repeat once more Matthew Arnold's fine phrase, "the friend and aider of those who would live in the spirit." His harsh and sometimes cryptic poems continue this purpose. Towards the transcendental follies of his followers, such as Amos Bronson Alcott or the Brook Farm enthusiasts, he was tolerant, but, unlike Thoreau who endured jail rather than pay his poll-tax, Emerson was

usually aloof. Yet, both as a writer and as a lecturer, a medium which produced *The American Scholar*, 1837, and unforgettable pictures of him, rapt, meditative, reading in his clear, sweet voice, he engaged in battle concerning slavery and other issues. In American literature Emerson remains the highest modern product of its Puritan tradition.

About him during this flowering of New England, in Concord, Cambridge, Salem, Boston, or Haverhill, wrote Thoreau, "Emerson made concrete"; Hawthorne, brooding over the unseen moral world; Longfellow, though suffering tragedy in his own life, composing verses, too fluent and too naïve for modern ways, but moving the humble reader, in *A Psalm of Life*, *My Lost Youth*, *Hiawatha* or *Evangeline*; and Whittier, with his memories of the farm in lyric and *Snow-Bound*. Holmes describes the homespun mingling of simple and cultivated life less in his endless, witty jingles than in his table-talk of *The Autocrat of the Breakfast Table*, 1857-58. JAMES RUSSELL LOWELL, somewhat younger, complaining that he had too many thoughts and too little thought, reflects perhaps more than all these the multiplicity of interests of the New England group. His talents for lyric poetry, satire, criticism in verse and prose are evident, to cite isolated examples, in *After the Burial*, *The Biglow Papers* and *Among My Books*.

Nor was the golden stream only from the springs of New England. In the Berkshires, in the middle of the century, the New Englander, Hawthorne, hobnobbed with a congenial spirit, HERMAN MELVILLE (1819-91), born in Albany, sailor of the seven seas, and afflicted, like his friend, the dweller in the Old Manse, with the sorrowful gift of genius. Melville's fame has come late, but his *Typee*, 1846, *Omoo*, 1847, *Mardi*, 1849, and *Pierre*, 1852, reveal not only a knowledge of the ways of ships equal to that displayed by RICHARD HENRY DANA, JR. in *Two Years Before the Mast*, 1840, but also a spirit meditating on the darkness of life. *Moby Dick*, 1851, is the supreme example of Melville's marine lore and mysticism. And in Baltimore, two years before the publication of this bizarre book, died another lonely spirit, at odds with this environment of commercial America. EDGAR ALLAN POE (1809-49), orphaned at an early age, committed to an unsympathetic guardian, had thus ended a life in which contended poverty, disease, maladjustment and, as Carlyle would say, "burning fire of genius."

Arrogant and sensitive, endowed with a brilliant mathematical mind, Poe was forced for a livelihood to slave for magazines which often thought his short stories inferior to the effusions of the lady-poetesses of the sentimental, genteel school, and to exhaust his powers, which were essentially those of a poet, in stories which ranged from the morbidly horrible to sarcastic banter. Yet in these he displayed both his splendor of imagination and his analytical faculties, though he cannot be accurately called the father of the modern detective story. A few of these, first recognized abroad, are probably immortal, such as

*Ligeia*, *The Fall of the House of Usher*, or *The Masque of the Red Death*. In these tales and even in his criticism by which in his age he terrified the orthodox and the inane writers—plucking several hairs from the beard of Longfellow—it is true, as in his poetry, that Poe's roots are not in the South which claims him, or indeed in America. They are in that unknown realm of poetry which he describes again and again, in *Israfel*, *The Raven*, *Ulalume*, or *The City in the Sea*. Imitator, plagiarist, mocker, Poe may nevertheless be called the only pure artist in literature produced by America during the 19th century.

A thorough roll-call of writers in the school of literature about 1860 would list a hundred names, some sadly shrunk from a gigantic contemporary popularity. Slender space permits only mention of other prolific Southerners, such as William Gilmore Simms (1806-70), whose novels, some modern critics assert, surpass Cooper's; such New Englanders as Cranch, Very, William E. Channing, and HARRIET BEECHER STOWE. At the outbreak of the war which was to dim the elegant parlor traditions of Longfellow and his school, Henry Timrod (1829-67), John E. Cooke (1830-86) and Paul H. Hayne heralded the transfer of the scepter away from New England. This southern group, followed after the peace by the silvery flute-wail of SIDNEY LANIER, musician and metrist, presaged a wider field for American letters. Yet, with the downfall of the planters' aristocracy, the center was not to be in the South, but in that bolder country, from which Illinois soldiers had come to fight side by side with Pennsylvanians and Vermonters. Westward, then, more than ever, in 1865, flowed the tide of immigration, spreading the frontier and semi-frontier civilization beyond the Mississippi, and on to the Pacific slope. From this land of equalitarians, miners, river-pilots, ranchmen and pony-express writers was to come "the new American literature."

Yet America had already heard its trumpeter, WALT WHITMAN (1819-92). In 1855 he had sent a copy of his *Leaves of Grass* to Emerson, whose loyal but shaggy disciple he was. Year after year Whitman, carpenter, printer and school teacher, sounded his "barbaric yawp," shook hands with freeman, tramped the open road, bunked with cabmen and ferryboat pilots, and, finally, won the affection of a nation by his service in the hospitals during the Civil War. In his one book, with its hundreds of poems, Whitman contrived to expound with undiminished vigor his monistic doctrines of God and Man, of democracy, of "these States." His illiteracy, his animality, his convention-defying patterns of verse shocked the country, but could not hide his indisputable genius as a hymner of life and of America.

A certain vagueness of thought and feeling still hinders the full understanding of Whitman; not so another Titan of American soil, SAMUEL CLEMENS ("Mark Twain," 1835-1910); he is of the earth, earthy. Clemens knew the Mississippi River, on

whose banks in Missouri he was born, and down whose tortuous eddies he piloted steamboats. He served briefly in the Confederate Army, struck West, mingled with trappers and miners, and in San Francisco in the late '60's fell under the influence of Bret Harte. His career in literature following Harte's suggestion that he print *The Jumping Frog of Calaveras County*, 1867, was meteoric. In book and lecture he bathed the nation in frontier humor, and then, to their astonishment, when rich and living securely in the East, he emitted streams of fire against reverence for the past, Christian Science, Walter Scott and life itself, from which he longed, he said, to extract the oxygen for a few minutes and destroy every living creature. The secret lies less in psychoanalysis to which he has been pitilessly subjected than in a comprehension of the standards of the frontier whose shining representative he was. Badly educated, he clove to the end to the simple code of honesty and independence, a code often violated in "the Gilded Age" in which he lived. When all possible has been said of his satire in this book, of his romantic idealism in *Personal Recollections of Joan of Arc*, 1896, of his pessimism in *What is Man?*, 1906, the lover of American literature will return, even as Mark Twain at the end of life wished to return, to *Life on the Mississippi*, 1882, *Roughing It*, 1872, *Huckleberry Finn*, 1884, and *Tom Sawyer*, 1876. In these books he expressed the frontier's relish for life, its crudeness, its very guffaws.

BRET HARTE (1839-1902) piled on this bonfire, which threatened to consume such survivors of the old tradition as T. W. Higginson, George W. Curtis, Bayard Taylor, Thomas Bailey Aldrich and E. C. Stedman, his combustible poems and short stories of the Pacific coast. These were full of eccentric characters (Cherokee Sals and Tennessee's Partners), dialect and carefully dramatized events. But Harte was an Easterner, and had gone West for literary material. *The Luck of Roaring Camp* and *The Outcasts of Poker Flat* merely show the extent of this conflagration of native western themes. JOAQUIN MILLER (1841-1913), with his *Songs of the Sierras* upheld with his followers the tradition of the West in literature, while in all sections of the Union writers sprang up, dealing an immense variety of new themes: Ambrose Bierce (1842-1914); Stephen Crane (1871-1900), "O. Henry" (1862-1910), and Jack London (1876-1916). (See separate articles on these authors.) Actually, of course, all this bumptious writing was reaction against the dominance of England, a fulfillment of Emerson's injunction that in literature, too, we should "walk on our own feet." Gradually, the fervor subsided into the half-romantic, half-realistic local color school. Everywhere the new American writers dug in their own backyards: HELEN HUNT JACKSON in Southern California; Edward Eggleston in Indiana; Constance F. Woolson in the Northwest; GEORGE W. CABLE in Louisiana; Joel C. Harris in the South, and so on, endlessly. Even in the "abandoned farm" of New England literature, as one critic called it, Sarah Orne

Jewett, EMILY DICKINSON, and others wrote of subtler moods with distinction. Yet the master of the American scene was WILLIAM DEAN HOWELLS (1837-1920), who had hoed corn in Ohio, but now sat in the editor's chair of the *Atlantic Monthly*. Unseduced by the sirens of the romantic tale, like Francis Marion Crawford's, or of the tale of Naturalism, now having its vogue under French influence, he held to his "reticent realism," depicting in many novels the even surface of commonplace American life, and exhibiting deeper undercurrents in *A Modern Instance* and *The Rise of Silas Lapham*, 1885.

**Twentieth Century.** It was Henry James (1843-1916) who went farther, probing the minds of these Americans and contrasting their emptiness, as he implied, with the fulness of those of the cultivated Europeans. Between *The American*, 1877, and *The Wings of the Dove*, 1902, may be traced the whole history of James's hypersensitive artistic revolt from the sterility of American life, until in 1915 he became a British subject. In nuances of feeling, thought and style he portrays the subtleties of character which, in the last analysis resolve, as one critic has said, merely into "a tour of Henry James's inside." This tendency to play variations upon the somber string of realism has been, on the whole, persistent during the three decades of the 20th century. Instead of ignoring American themes, writers now subsist upon them. Following the mandate of Wells in England that nothing, however sacred or ugly, shall be excluded from the novel, American writers of fiction have thrown a searing glance upon the countryside, as in *Ethan Frome*, by EDITH WHARTON; upon the village, as in the novels of SINCLAIR LEWIS; upon our social conditions, as in *An American Tragedy*, by THEODORE DREISER. The indictment is continued in poems on the village by Edgar Lee Masters, on steel-mills by Carl Sandburg; and on, unconsciously perhaps, politics and democrats in general, by Vachel Lindsay. In this brief study the many-colored quilt can not be cut to a single color. It may be said merely that serenity and tenderness are here, as in the strong poetry of ROBERT FROST or the profound novels of WILLA CATHER; technique, as in the stories of Joseph Hergesheimer; grace and spirit, as in the novels of James Branch Cabell or the poems of Edna St. Vincent Millay; and free-glancing criticism, as in Stuart Sherman and H. L. Mencken. What matters, perhaps, is the Americans' consciousness of their past and their awareness that they themselves are now makers of literature. S. T. W.

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**AMERICAN MEDICAL ASSOCIATION.** See MEDICAL ORGANIZATIONS.

**AMERICAN MUSEUM OF NATURAL HISTORY** in the city of New York, was founded in 1869, and has become the most extensive in the United States in its collections and in its activities.

Its buildings cover a large area given by the city and affording room for wide expansion; the grand entrance, in Central Park at West 77th Street, was erected by the state of New York at a cost exceeding \$3,500,000, as a memorial to Theodore Roosevelt, President of the United States, 1901-09, and a former trustee. This museum is supported partly by money appropriated by the city, and partly by revenues from endowments, gifts, and about 12,000 memberships. It is governed by a board of 33 trustees assisted by an administrative staff, and by a scientific staff directed since 1895 by Dr. Henry Fairfield Osborn, president, including scholars of world-wide repute. A library of nearly 125,000 volumes is at their service and available to students, and specialists. The public may have access to the reserved series of specimens under suitable conditions. Several series of scientific Memoirs are issued, containing studies by the staff and the field workers, and an illustrated magazine, *Natural History*, is published.

The collections displayed or stored encompass the whole breadth of zoology and ethnology, in the latter department with special attention to the North and Central American aborigines and their prehistory; and the exhibition-halls are open free to the public every day. These collections have been gathered mainly by research-expeditions sent to all parts of the world. Thirty-four such expeditions were abroad in 1930, including the celebrated investigation of the Gobi Desert and eastern Mongolia, which has continued thus far for 10 years, and has been richly productive, particularly in the field of palæontology. This museum has led the world in the improvement of taxidermy and the methodical display of the objects on view, which are grouped in regional halls, with panoramic backgrounds painted by Museum artists in the locality where the groups are collected and which are composed of the actual materials of environment collected with the specimens exhibited.

The ruling policy of this museum is educational. Free lectures are given to the public almost daily during the winter, especially for young people. Facilities for study in many lines are constantly utilized, not only by the teachers and pupils of the schools of the city and state but by those of other states, through loans of instructive picture-films, traveling collections, and other cooperation with local educational institutions.

In addition, the Museum operates the Trailside Museum at Bear Mountain every summer, where the many visitors are taught many valuable facts in natural science on the nature trails which are laid out in the section. E. I.

**AMERICAN PARTY.** See KNOW NOTHING PARTY.

**AMERICAN PROTECTIVE ASSOCIATION**, a secret order founded Mar. 13, 1887 at Clinton, Iowa. Its chief doctrine, as embodied in its declaration of principles, held that support of any ecclesiastical power of non-American character, which claims equal or higher sovereignty than that of the United States

Government, is irreconcilable with American citizenship. It also opposed the holding of a political office by any "subject or supporter of such ecclesiastical power." In many respects it was similar to the earlier Know Nothing Party, differing from it, however, in permitting foreign-born persons into membership. Although not a political party, the A.P.A., as it was popularly known, sought the election of political candidates friendly to its aims. At the height of its influence, 1890-96, the membership of the organization totaled about 120,000.

**AMERICAN SAMOA**, a dependency of the United States consisting of seven islands in the south Pacific about 4,200 mi. southwest of San Francisco and 200 mi. east of Australia. They include Tutuila, Annuu, Otu, Olosega, Tau, Swain's Island and the uninhabited coral atoll of Rose Island. The total area is 76 sq. mi. The people are largely native Samoans, a branch of the Polynesian race. The islands are mountainous with a moist tropical climate. Mean temperature in Dec. is 79° F. and in July 76°. The soil is remarkably fertile and produces abundant crops of coconuts, citrus fruits, bananas, taro, yams, sugar cane, coffee and tobacco. Copra, the dried kernel of the ripe coconut, is the only export. In 1929 the island produced 1,687 tons of copra worth \$147,215.90, most of which was shipped to the United States.

PAGO PAGO, the capital on Tutuila, is the port of entry and has the best and safest harbor in the South Seas. It is the site of the United States naval station headed by a commandant who is also governor of the islands by appointment of the President. The islands are divided into three administrative districts, each under a native governor, and at the head of each village is a native chief. In 1930 there were 20 public schools with 2,044 pupils and four private schools with 350 pupils.

These islands were independent until 1899 when they became a possession of the United States through a treaty with Great Britain and Germany. In 1930 they were visited by a Congressional committee charged with drafting an organic act and bill of rights. The committee recommended American citizenship without bringing the people under the Constitution. Pop. 1930, 10,055.

**AMERICAN SOCIETY FOR TESTING MATERIALS**, a national society of engineers, chemists, designers, testing experts, manufacturers, users, and others for the promotion of knowledge of the materials of engineering, the standardization of specifications and methods of testing. Annual meetings are held. The papers and committee reports there presented are published in the "annual proceedings." Development of standard specifications for materials and methods of testing is done by committees and finally approved by vote of the members. The society was organized in 1898.

**AMERICAN SOCIETY OF NATURALISTS.** As stated in its constitution, this is an "association of working naturalists for the discussion of methods

of instruction, museum administration, and other objects of general interest to investigators and teachers of natural science; and for the adoption of such measures as shall tend to the advancement and diffusion of natural science." The organization was founded at Springfield, Mass., in 1883, as the "Society of Naturalists of Eastern United States," and several years later took its present name. Membership in the society is limited to persons professionally engaged in some branch of natural history, as instructors in natural history and officers of museums and other scientific institutions. Meetings are held annually.

**AMERICAN STANDARDS ASSOCIATION**, a federation of over 45 national technical societies, trade associations, and governmental bodies, for the purpose of bringing together manufacturers, distributors, consumers, technical specialists, and any others interested in the development of a standard specification for a material or for a method of making a test. The standards are developed by technical committees and finally adopted as standards by the Standards Council composed of representatives of all member bodies. The association was organized in 1918 as the American Engineering Standards Committee.

**AMERICAN THEATER AND DRAMA, THE.** The beginnings of American drama were not indigenous to the soil. One finds no legendary plays dealing with the superstitions and customs of the Indians, and it was a long while before Americans were artistically conscious of their surroundings. They are more so to-day than in the period of colonization. Both theater and drama as viewed here were imported from England, and the taste of American theatergoers for many decades—for centuries as a matter of fact—was English taste. The technique of the playwrights was imitative, not individualistic.

When did the American theater begin? Was it with the arrival of Cortez in 1524, when he planned to cross the peninsula of Yucatan to the northern coast of Honduras? One is told that with his hundred horsemen and his forty foot-soldiers he brought musicians and jugglers. Scarcely does it behoove students of the American theater to worry over Peruvian culture or Aztec drama. Again one is confronted by the consideration of Champlain's effort during the winter of 1606-07 at Port Royal to enliven his colony with *The Theater of Neptune*, written by Marc Lescarbot, and acted under the auspices of the *Ordre de Bon Temps*. One is thus tempted to say that Cortez brought to America the first actors, and that Champlain encouraged the first dramatist.

Localities become definite, but the priority of dates remains debatable. On Aug. 27, 1665 in Accomac County, on the eastern shore of Virginia, a play called *Ye Beave & Ye Cubb* was performed with Cornelius Wilkinson as the chief actor. The students of William and Mary College gave a "pastoral Colloquy" before the governor in 1702, whether at the college or at the executive "palace" is not proven. Some years before, Virginia had been ruled by Sir William Berkeley (1610?-77), himself accounted a

dramatist of no mean importance. In New York, another governor, Robert Hunter, had put his hand to the writing of a farce, which was published in 1714 under the title of *Androboros*, the only copy of which is owned by the Huntington Library. A semi-political tract, probably never acted, it was replete with satire aimed against Trinity Parish.

The dates creep onward. On July 11, 1716, a building contract was recorded at Yorktown, Va., for a theater to be erected in Williamsburg. The venture was unsuccessful, and by 1735 it became a home for amateur players. The young "gentlemen" of the college seem, however, to have been the chief entertainers at Williamsburg and were presenting *Cato* in 1736.

The importance of Charleston, S.C., now enters with the name of a strolling player, Anthony Aston (b. about 1682), who came to the colonies in 1730, landing in Charleston. Eola Willis in *The Charleston Stage in the XVIII Century* champions this town by saying that it had a theater 15 years before the New York Nassau Street Playhouse, 1749-50, and more than 30 years before the Philadelphia Southwark Theater, 1766. She claims Charleston's first theater season to have been 1734-35, and quotes a first American prologue to have been written for *The Orphan*, Jan. 24, 1734-35.

This chronological record ends with the Murray-Kean season in New York, 1749-50, when they tried to steal the thunder of the Hallams; and with the Boston "scandal" of 1758, when the students of Harvard regaled themselves with performances of *Cato*, *The Drummer* and *The Roman Father*, though the diatribes against the theater of such straight-laced ancestors as Judge SAMUEL SEWALL (1652-1730) were still gospel to the majority, even though uttered in 1685. The records of forgotten centers such as Annapolis, Md., Newport, R.I., and Wilmington, N.C., may add new facts to this progression. Such colonial papers as the *Virginia Gazette* have still to be carefully gone over as Miss Willis has searched the *South Carolina Gazette*, and Prof. George C. D. Odell has examined the papers of New York City.

William Hallam (1712-58), called the projector and father of the American theater, did not act in America; he was the organizer of a company that came over under his guidance. They sailed from England on the *Charming Sally* in May 1752. Soon afterwards he sold his interest in the enterprise to his brother Lewis, and returned home to die. Lewis and his associates were in Williamsburg, Sept. 5, 1753, when the vivacious Miss Hallam appeared as Jessica in *The Merchant of Venice*, and inflamed the hearts of Virginia youth. The theater life of the time is reflected in John Esten Cooke's novel, *The Virginia Comedians*. Dunlap knew well the grandson of William Hallam, another Lewis. The Hallams were the chief players in the colonies for the remainder of the century.

Colonial drama might scarcely be called either prolific or distinctive. It consisted of imitative verse

and exotic theme. This was particularly true of the first so-called American tragedy to be published, *The Prince of Parthia*, by THOMAS GODFREY (1736-63). It was in accord with the style of Addison and was just about as native as Shakespeare's *Tempest*, 1611, and Jonson's *Eastward Ho!*, 1605, which were among the first to mention America in dialogue. It was not so native as Mrs. Aphra Behn's *Widow Ranter*; or, *Bacon in Virginia*; or her novel, *Oroonoko*, 1696, on the subject of slavery—a forerunner of *Uncle Tom's Cabin*. *The Prince of Parthia* was played by the American Company, headed by David Douglass, who married the widow of the first Lewis Hallam.

Published the same year were two plays of historical ambition, *The Conquest of Canada*, 1766, by George Cockings; and *Ponteach; or The Savages of America*, 1766, by Robert Rogers, the latter the first American problem play. In both dramas there is distinct personal feeling. Rogers upheld justice to the Indian and foreshadowed Stone's *Metamora*, which Edwin Forrest brought to distinction; it was a forerunner of James Fenimore Cooper's *Red Man*. Meanwhile, in the colleges incipient dramaturgy raised its head in the form of "dialogues," and as early as 1762, a "Dialogue" called *The Military Glory of Great Britain* was apt with loyalty to the Crown. Such patriotic spirit was to alter soon with the shifting of political events. The colonial attitude toward the theater was varied; the great contention was the actor against official prejudice and legal handicaps. COTTON MATHER scored the stage in 1686. Samuel Sewall in 1714 protested against it. Even in Virginia, Samuel Davies deplored the threatening presence of the actor. General assemblies made laws against vagabond players; actors appealed their cases in the papers; constables chased Thespis on horseback through the countryside. Often the drama had victory over law. But Quakers and other sects vigorously opposed play-acting. David Douglass in 1758 called the theater at Cruger's Wharf in New York an "Historic Academy," to overcome prejudice; he arranged *Othello*, in Newport, as a "moral dialogue," "Depicting the Evil Effects of Jealousy and other Bad Passions, and Proving that Happiness can only Spring from the Pursuit of Virtue."

It was strange that the college presidents of the time, instead of frowning in Puritan fashion upon the frivolity of make-believe, encouraged the drama. College and school dramatics thus early flourished in America, and the amateur had many opportunities for self-entertainment.

The rising tide of political conflict became reflected in the temper of the dramatists. PHILIP FRENEAU (1752-1832) and HUGH HENRY BRACKENRIDGE (1748-1816) wrote a "Dialogue" under the encouragement of President Witherspoon of the College of New-Jersey (Princeton). It was called *The Rising Glory of America*, 1771. With the declaration of war between the colonies and the mother country, the tone of pamphleteer dramas was purposefully anti-Tory in sentiment.



The Continental Congress in 1774 ruled against the theater as diverting the public mind from the serious matters of war at hand. The American Company exiled themselves in Jamaica. Washington frowned upon the official strictures against theater-going. He was America's first real "first nighter." In 1778, the Congress issued another manifesto, indicating that even among patriots there was occasional law-breaking.

The Revolutionary War dramatist *par excellence* was Mrs. Mercy Warren (1728-1814). She crossed swords with General John Burgoyne (1722-92), who himself boasted dramatic talent. He wrote *The Blockade of Boston*, 1776, a fair exhibition of Tory spleen, and she retorted with *The Blockheads; or, The Affrighted Officers*, 1776. Dramatists in this country neither before nor since have been so close to the event as Mrs. Warren when she published her play, *The Group*, the day before the Battle of Lexington. This was a sharp satire and a first-hand impression of the enemy, more historical document than drama. Brackenridge was no less fervent and patriotic in his *Battle of Bunker's Hill*, 1776, a glorified educational drama by a dominie dramatist who hoped that the piece would be acted generally by all academies of the country. The period produced also the first chronicle play in the colonies, *The Fall of British Tyranny*, 1776, by John Leacock; a key to the piece indicates that all types of British were lashed.

On the other hand, Tory pens were equally splenetic. *The Battle of Brooklyn*, 1776, authorship unknown, scornfully treated the Continental leaders and Washington came in for his full share of satiric ridicule. Perhaps the most distinctive Tory tract in drama form was *A Cure for the Spleen*, 1775, by Jonathan M. Sewall (1748-1808). Such dramatic literature was opportune. Its style was propaganda, and it possessed small literary and no theater value.

The playhouse of the revolutionary era was in the hands of the soldier enemy. In excellent fashion, the Red Coats took hold of theater management and acting. In Philadelphia and New York they made a business of entertainment, and found many Tory belles to play with them. For five seasons in New York, the John Street Theater—renamed the Theater Royal—was run at a profit. General Sir Henry Clinton (1738-95) may be regarded as the first commercial manager in New York. The chief Red Coat scenic artist of the day was Major John André (1751-80). To him was also largely due the success of the Philadelphia *Meschianza*, 1778, a spectacular pageant given by Royalists in honor of General Howe, recalled to London. During these years, the theaters were small replicas of London in repertory and spirit. Among their accomplishments was a performance of *The Rivals*, given its first night in America on Apr. 21, 1778.

One now approaches the strictly national period. Following the Revolution, the professional actors returned to America and theaters resumed their routine repertory. The consideration of a constitution for

the new republic found reflection in plays like Samuel Low's *Politician Outwitted*, 1789. But before the new century began, two theater events were significant. The first native comedy, *The Contrast*, by Royall Tyler (1757-1826), was produced by Hallam and Wignell on Apr. 16, 1787. A pale imitation of *The School for Scandal*, it was nevertheless the first native drama to represent the Yankee on the American stage, and it used the ballad, *Yankee Doodle*, previously introduced into an American opera, *The Disappointment; or, The Force of Credulity*, 1767, by Andrew Barton. WILLIAM DUNLAP (1766-1839) followed Tyler's success with his own *Modest Soldier; or, Love in New York*. As theater manager and as historian Dunlap easily became the true father of the American theater. *André*, 1798, is typical of his style. To him, through his glorification in translation and adaptation of the plays of the prolific August Friedrich von Kotzebue (1761-1819), may be credited the start of that pernicious dependence of the American theater on cheap foreign farces, comedies and melodramas—a dependence hard to shake off for many decades. Dramatists contemporary with Dunlap were Samuel Woodworth (1785-1842), James Nelson Barker (1784-1858), John Howard Payne (1791-1852) and M. M. Noah (1785-1851). From these could be found only a small part of American life. Woodworth's *Forest Rose* continued, however, the Yankee type tradition started by Tyler.

With the beginning of the 19th century, the American theater was concerned with celebrated players who came to these shores through managerial inducement; for instance, George Frederick Cooke (1775-1812), EDMUND KEAN (1787-1833), William Augustus Conway (1798-1828) and Thomas Abthorpe Cooper (1776-1849). Upon the style of American acting for several generations they were to exert profound influence. Even thus early the American theater boasted a "star" system. Such dramatic critics as William Coleman (1766-1829) of the New York *Evening Post*, and Robert Treat Paine (1773-1811) of Boston, and such a genial commentator as WASHINGTON IRVING, judged plays according to SPECTATOR standards.

In the first 25 years of the century, theater territory was opened up, not only in the East but in the mid-West and South. N. M. Ludlow (1797-1886), author of *Dramatic Life as I Found It*, and Sol Smith (*Theatrical Management in the West and South*) are the historians of the actor as pioneer. James H. Caldwell (1793-1863) was also identified with pioneer theaters of the Mississippi valley. By 1832, British travelers were coming in large numbers to American shores. Such players as FANNY KEMBLE (1809-93) and Tyrone Power (1799-1841) have left vivacious comments of the times, as has also John Bernard (1756-1828). Every season the American theater under live managership—as of William B. Wood (1779-1861) of Philadelphia, Stephen Price and Edmund Simpson (1784-1840), of New York, and Francis Wemyss (1797-1859), of Philadelphia—saw adequate players

added to the roster. Dunlap comments on the excellencies of John Henry (d. 1795) and John Hodgkinson (c. 1767-1805). From England came Mrs. Melmoth, Mrs. Oldmixon and Mrs. Whitlock, a sister of Mrs. Siddons and John Kemble. Thomas Wignell (c. 1753-1803), who plied his trade between New York and Philadelphia, was most successful as recruiter. Even Cooper recognized the dignity of James Fennell (1766-1816), a player of sound worth famed for his Othello.

Edwin Forrest (1806-72) hailed himself, *par excellence*, as an American actor. His model, however, was Kean. His extreme Americanism helped, in competition with the jealousy of the contemporary English actor, WILLIAM C. MACREADY (1793-1873), to precipitate the New York Astor Place riots of May 1849, while Macready was playing *Macbeth* at the Astor Place Opera House. To Forrest is given undue credit for having furthered the American drama. He offered prizes for plays built to suit his style and physique. Nine dramas were thus written for him, mostly exotic in subject matter: *Metamora*, 1829, by John Augustus Stone (1801-34), who also wrote for him *The Ancient Briton*, 1833; *Caius Marius*, 1831, by Richard Penn Smith (1799-1854); *Pelopidas*, by Robert Montgomery Bird (1806-54), who also wrote for Forrest *The Gladiator*, 1831, *Oroloossa*, 1832, and *The Broker of Bogata*, 1834; *Jack Cade*, 1835, by Robert T. Conrad (1810-58), and *Mohammed*, 1851, by G. H. Miles (1824-71). These dramatists were known as the "Philadelphia School." The most important member was George Henry Boker (1823-90), who did not write for Forrest and whose most distinctive drama was *Francesca da Rimini*, 1855. New York offered in friendly rivalry the "Knickerbocker Group" of playwrights, among whom N. P. Willis (1806-67), Cornelius Mathews (1817-89) and Anna Cora Mowatt (1819-70) were outstanding. Mrs. Mowatt's *Fashion* represented realism and subtlety for the theatergoers of 1845 in its attack on parvenuism. It was the forerunner of Mrs. Bate-man's *Self*, 1856, and Howard's *Saratoga*, 1870.

In the lowly arts, national traits were making rudimentary imprint upon the stage. Type dramas flourished because certain excellent artists brought them some semblance of reality. Dan Marble (1807-49) was the exponent of Yankee character; "Yankee" George Handel Hill (1809-49) and Joshua Silsbee (1813-55) vied with him in public favor. It was Marble in 1844 who sponsored such plays as C. A. Logan's *The Vermont Wool-Dealer*, 1840, and *Yankee Land*, 1834. Dr. J. S. Jones (1809-77) wrote *The People's Lawyer*, 1839, and a realistic touch from the actor, John E. Owens, made Solon Shingle live. James H. Hackett (1800-71)—famous Falstaff of his day—was proud of his dialect rôles. He was the first to play Lot Sap Sago and the first to appear as Rip Van Winkle in an early version antedating Boucicault's script. "Down East" dramas flourished in the '30s and '40s.

Not one out of the long list of Indian plays writ-

ten by such authors as G. W. P. Custis (1781-1857), John A. Stone, Richard Penn Smith, Robert Montgomery Bird survived their wooden doom; and only *Metamora* is remembered because Forrest made it memorable by his florid elocution, and John Brougham's burlesque made it enjoyable. An occasional historical drama, such as N. H. Bannister's *Putnam, the Iron Son of '76*, 1857, J. G. Burnett's *Blanche of Brandywine*, 1858, and Oliver Bunce's *Love in '76*, 1857, struck a patriotic note in America drama. And these pale records were a long time in coming. Their scenes were gaudy panorama, their sentiments over-fulgent. Such a local drama as B. A. Baker's *A Glance at New York*, 1848, gave the character actor, F. S. Chanfrau, in the rôle of Mose, opportunity to suggest the flavor of the volunteer fireman and the Bowery boys of New York. James K. Paulding's *The Bucktails; or, Americans in England*, 1847, afforded in print a glimpse of frontier and democratic manners. Two distinctly American types that shone on the contemporary stage of a later era were the Hon. Bardwell Slote, in Benjamin E. Woolf's *Mighty Dollar*, lusciously delineated by the excellent comedian, W. J. Florence (1831-91); and Colonel Mulberry Sellers in Mark Twain's *Gilded Age*, 1874, made irresistible by the comedian, John T. Raymond (1836-87). These were the sparse attempts at realistic treatment of native character and scene in American drama. The Negro idiom as introduced into legitimate plays was crude, unreal pidgin-English. Mrs. Mowatt's Negro dialect in *Fashion* was no better than Poe's in *The Gold Bug*.

The fact is that during the first half-century period, managers like Stephen Price, who presided over New York's famous Park Theater for so many seasons, were not American-minded, nor were they that for years. Lester Wallack, Albert M. Palmer and Augustin Daly (despite his dalliance with W. D. Howells, Bret Harte, Henry James and Mark Twain) also did not possess this quality. It was cheaper, because of copyright laxness—a laxness deplored as early as the '40s by Cornelius Mathews—to delve into the European trash-baskets and draw forth French and German second-rate plays. The taste of the day was also satisfied by the wave of dramatization of Scott and Dickens that swept over the theater, taken advantage of by W. E. Burton (1804-60) and John Brougham (1810-80). Burton was a noted Captain Cuttle, Falstaff and Bottom, and a most intelligent manager. Hutton called Brougham an American Aristophanes, a term applied later by Brander Mathews to Weber and Fields, the great burlesquers of the '90s.

In all sections of the country new playhouses were being established and new reputations being sustained. New York was the center of activity. The old John Street Theater was outmoded by the Park Theater; the Park was hard-pressed by the reputation of the Bowery Theater so vigorously managed by Thomas S. Hamblin (1798-1853). In Philadelphia, the Southwark Theater gave way to the Chestnut

Street Theater, 1794. Boston's first theater was called an Exhibition Room, but the Federal Street Theater and the Haymarket rose to face Puritan opposition before the close of the 18th century. The history of the Providence stage reveals the discomfiting experience actors faced in Rhode Island. The careers of the different theaters constitute the history of play-acting in America. Niblo's in 1834, William Mitchell's Olympic in 1848, the Boston Museum about the same time, the Arch Street Theater in Philadelphia, made so memorable by the direction in later years (beginning Aug. 3, 1861) of Mrs. John Drew (1820-97)—all these centers even to the very coast had their special excellences. The theater shared in the pioneer stretching of frontiers. It followed the gold-seeker to California, as the career of Lotta Crabtree (1847-1924) suggested vividly, since her first stage salary was paid in gold nuggets flung to her while she sang to the miners. Baltimore, Richmond, Chicago, Salt Lake City, Virginia City, San Francisco have their special histories. Theaters like the showboat of William Chapman and family, floated along the Ohio and Mississippi rivers.

In and out of various casts the famous actor-families of America intertwine. Each family has its distinctive tone and temperament: the morose streak of the Booths (see *BOOTH FAMILY*), Junius Brutus, Edwin and John Wilkes; the persistent comedy of the Jeffersons, best remembered by JOSEPH JEFFERSON and by William Warren (1812-88), of Boston Museum fame, whose family crossed in marriage with the Jeffersons; the Wallacks, whose romantic temper was set by the Benedick of James William (1795-1864); and maintained by John Lester (1820-88), the hero beau ideal of the theater of the '70s. The annals of the stage are the richer for such names as the Placides, the Drews, Barrymores, Davenport, Hacketts, Hollands, Powers, Sothens, and the Boucicaults. Those golden days of acting were the rare days of the American theater, the poor days of drama. With all this theater power, the American drama continued to remain aloof from American life. Only through reactions to entertainment that had nothing to do with local conditions, can one interpret the American theater in a social way. The strange inconsistency of Puritanism was no better seen than in the public reception of Fanny Elssler (1810-84), the *danseuse* who triumphed in America during the "fabulous forties," the entire country at her feet. From those days to the sinful days, 1866, of *The Black Crook*, by one Charles Barras, tongues wagged over the problems of attenuated skirts and tights, kept wagging by the handsome proportions of Adah Isaacs Menken (1835-68) and the Lydia Thompson Blondes. New England roared in rage because Fanny Elssler desired to contribute to the Bunker Hill Monument Fund! Boston lads in 1850 shyly applauded the divine arias of the Swedish nightingale, JENNY LIND (1820-87). In those days passions were best spent on political issues, the most serious of which, slavery, was to give the theater its greatest sensation, a drama-

tization against the author's will by George L. Aiken of Mrs. Stowe's *Uncle Tom's Cabin*, 1852, with the Howard family.

The development of Negro minstrelsy was another important aspect of the American theater, Thomas D. Rice (1808-60) really fathering the idea when he danced and sang *Jump, Jim Crow* in 1832. (See also *MINSTREL*.) It was further developed by Dan Emmett (1815-1904), who organized the first minstrel show in 1843, and by Edwin P. Christy (1815-62), who fixed its form. In its infancy it thrived on the sentimental plantation music of STEPHEN FOSTER (1826-64). That it is dead to-day is partly due to the lack of feminine attractiveness in the show, and to the fact that the minstrel refused to remain true to his original "black face" character, and introduced French, German and Irish novelties into the program.

The theater of the '50s was overtopped in its claim as a national institution by the lumbering figure of PHINEAS T. BARNUM (1810-90), amazing fakir and supreme showman. The public swallowed his bulk, fraud and all. He brought big scale and blatant advertising into the show business. He epitomized in his activities the ultimate three-ring circus. His Museum was regarded by those of the equally fabulous '60s and '70s as an educational blessing. Serious music critics claim that, by bringing Jenny Lind to this country, Barnum engraved his name deeply in musical record. From 1835 he humbugged theatergoers, and they liked him for it. In his own person he represented "Yankee" astuteness, and out from the dimming theatrical past, he stands to-day a Pecksniffian immortal.

There was carried over into the decades following the Civil War the general form of the theater just traced. LAURA KEENE (1820-73), that astute first American manageress who had in 1858 given Tom Taylor's *Our American Cousin*, in which E. A. Sothorn had created the famous rôle of Lord Dundreary, was the center of the national tragedy of the assassination of Abraham Lincoln by John Wilkes Booth; for she was playing this particular comedy at Ford's Theater, in Washington, on the evening of Apr. 14, 1865. The '40s and '50s were the years of golden repertory, to the interest of which Laura Keene added. To the very threshold of the '70s came the splendid traditions of Charlotte Cushman (1816-76), famed as Lady Macbeth and Meg Merrilies, of E. L. Davenport (1816-77), a scholarly actor, and of Edwin Forrest. But, into the hands of a newer generation was passed the stock company idea. DION BOUCICAULT (1822-90), the prolific dramatist, the genial Irishman who acted so superlatively in his plays, *The Colleen Bawn*, 1860, and *The Shaugraun*, 1874, and who wrote the much revived *London Assurance*, 1841, was always an innovator. He was more than a dramatist, and to him must be credited the idea of traveling companies which were to lead to the so-called "road" problem and to the complicated systems of "booking," and which opened the way for the formation of the all-powerful, stifling theatrical syndi-

cate of the '90s. Boucicault's contact was with the past and with the immediate future which involved the Madison Square Theater glories of New York, under the Mallory brothers.

The modern period of the American theater now opens. The stream carries one into the era when TONY PASTOR (1837-1908) strove to turn cheap variety and vulgar burlesque into refined entertainment; hence he is called the father of American vaudeville. Theater history was now in the hands of A. M. Palmer (1838-1905) with his Union Square Players, Agnes Ethel, Fanny Davenport, Rose Eytinge, Kate Claxton, J. H. Stoddart, James O'Neill, Clara Morris and Charles Thorne, the matinee idol. Those were the days of *Camille*, *The Two Orphans*, Bartley Campbell's *My Partner*, and such French innovations as *Rose Michel*, *The Danicheffs*, *A Celebrated Case* and *Daniel Rochat*. A. R. Cazauran (d. 1889) was the house dramatist or "play doctor." Here was produced Bronson Howard's *Banker's Daughter*, 1878, and here RICHARD MANSFIELD (1857-1907) played *A Parisian Romance*, 1883, the real start of his vivid, individualistic career.

AUGUSTIN DALY (1838-99) rose from journalism to the position of dramatist with an adaptation of H. R. von Mosenthal's *Leah the Forsaken*, 1862. He was to adapt and dramatize for many years. But his series of Daly theaters gave American theatrical history brilliant casts and brilliant revivals of the classics. He sponsored Fanny Davenport's beginnings in 1869 (she became the one lone exponent of Sardou in America), gathered together such players as James Lewis, Mrs. G. H. Gilbert and, last but not least, Ada Rehan and John Drew. He was old enough to have fallen under the spell of the beautiful Adelaide Neilson (1846-90), the ardent Juliet of her age who so enthralled Belasco in the early days and whose supremacy was only equaled by the sudden rise of Mary Anderson who made her debut in 1875 and whose spell as Perdita, Ophelia, Hermione and Parthenia was irresistible. Daly embellished slight farce by superior direction, and his classic and Shakespearian revivals, such as *The Country Girl*, 1884, *The Taming of the Shrew*, 1887, and *She Would and She Would Not*, 1893, though they disturbed Elizabethan scholars, delighted the public.

The name of Wallack had headed a New York theater since the '50s and had traveled uptown with the move of population. No gayer coterie of players existed than that which showed loyalty to the Wallack name. Lester was author of such a stage piece as *Rosedale*, 1863, and he shone supremely as actor in such adaptations as *Diplomacy*, *A Scrap of Paper*, *The Romance of a Poor Young Man*, and the English classics. Among the actors who came under Lester Wallack's direction were Rose Coghlan, H. J. Montague (another early matinee idol), and John Gilbert. Rose Coghlan's brother, Charles (1842-99), was not only a popular player, but a dramatist as well, author of *The Royal Box*.

In the midst of this modern trend, the old order

persisted; so did the old ideas. Edwin Booth rose on the tradition of his father and was supreme in the rôle of Hamlet. His was a memorable association with Lawrence Barrett (1838-91). The Players Club is Booth's real monument. HELENA MODJESKA (1844-1909) had the old manner, though she became so modern that she was among the first American actresses, as Nora in *The Doll's House*, 1883, to brave the realistic drama of HENRIK IBSEN. Elisa Felix Rachel (1820-58) in 1853 and Tommaso Salvini (1829-1916) in 1873 brought the glory of foreign acting to America, based on the conservatory idea. But Americans were always fortunate in their theater visitors like Adelaide Ristori (1822-1906), HENRY IRVING and ELLEN TERRY, SARAH BERNHARDT, Coquelin and ELEANORA DUSE.

In this way it is well to emphasize that the American theater was one of great acting rather than one of distinctive playwrighting. Dramatists witnessed managerial prejudice against the "home product." And in such an unsympathetic atmosphere it is a wonder at all that Bronson Howard (1842-1908), Charles Hoyt (1860-90) and Edward Harrigan (1845-1911) made their way. It can be said of Harrigan and Hoyt that they were more distinctively American than Howard. In the days when they were written, the Hoyt farces dealt with contemporary newspaper themes of interest, for example, *A Texas Steer*, 1894, and *A Temperance Town*, 1894; and were of unusual timeliness. Harrigan, with a keen eye for character types of the city, reproduced the flavor of Manhattan, when ward politics ruled and when "shantytown" flourished in many quarters. His invention of *Daniel Mulligan*, 1878 *et seq.*, alone entitles him to a unique place in the American theater. Howard took a definite stand in the '70s against any attempt to hide the fact that he was an American dramatist, and for that stand he was called the dean of American playwrights during many decades. He further stamped his American position by taking American subjects for his plays, as instance *Saratoga*, 1870, and *Shenandoah*, 1889. DAVID BELASCO (1853-1931), who had once been secretary to Dion Boucicault and who had flourished with James A. Herne (1839-1901) in the San Francisco theater days of Tom Maguire and E. J. ("Lucky") Baldwin, now broke upon New York and entered the "milk and water" drama days of the Madison Square Theater. At this theater, Steele Mackaye (1842-94) with "Hazel Kirke" and Henry DeMille (1850-93) and Belasco began their distinctive work. As one historian has said, "The times were ripe for the Frohmans."

And with the Frohman period, the American theater moved in broader sweeps toward commercial organization, toward concentration of the amusement interests of the country in few hands. With Charles and Daniel Frohman, the stock company idea flourished and died out. The "star" system interfered with well-balanced casts. The days of Daniel Frohman's little Lyceum Theater are linked with the progress of E. H. Sothorn, Georgia Cayvan, W. J. Le

Moyne, Herbert Kelcey, and with the beginnings of Mary Manning, Virginia Harned and James K. Hackett. The years of Charles Frohman's Empire Theater stock recall the names of John Drew, Maude Adams, William Faversham, Margaret Anglin, Henry Miller and Viola Allen.

Around him, both in New York and London, CHARLES FROHMAN (1854-1915) gathered the promising talent of acting and playwriting. His greatest dependence for plays was on CLYDE FITCH (1865-1909), best remembered for his feminine studies in *The Girl With the Green Eyes*, 1902, and *The Truth*, 1907, plays containing excellent literary style. But Augustus Thomas, with his pseudo-territorial plays, *Alabama*, 1891, *Arizona*, 1891, and *In Mizzoura*, 1893, and William Gillette, with his peculiar acting technique shown to advantage in his *Secret Service*, 1896, and *Sherlock Holmes*, 1899, were always at his call. It might well be said that whatever stereotyped character the American theater had at this time was due largely to the astute manipulation of Charles Frohman in setting forth interpretations of "what the public wanted" at the time. It is not, therefore, wrong to speak of the dramatists of the Frohman era, who catered to "stars," who dramatized novels, who wrote crook plays, who became meticulously feminine, or who knew exactly where to put the "punch" most profitably, as of the "Frohman School." It is surprising that under the spell of such requirements any originality came from such writers as Fitch and Thomas, George Ade and George M. Cohan.

The peak of commercial organization in the American theater was reached in 1896, when a central booking agency was organized by a group of theater men including Charles Frohman, Al Hayman, Marc Klaw and Abraham Erlanger. Players of independence, such as Mrs. Minnie Maddern Fiske and James A. Herne, rebelled against this. Even Sarah Bernhardt protested, to her discomfiture. The theater syndicate remained supreme until the Sam and Lee Shubert interests, called "independent," made the commercial incubus two-headed. At this point begins the decline of the old theater. Conditions were ripe for revolution.

Notwithstanding the mechanical routine of the theater which came about the time of the rise of the Frohmans (a depressing circumstance of which they were not the cause), the theater had its bright spots. David Belasco, the one great rebel of the theater of this time, insisted on being independent. From the days when he wrote plays like *The Wife*, 1887, *Lord Chumley*, 1888, and *The Charity Ball*, 1889, with Henry DeMille (1850-93), to the time when he became his own theater manager, his own playwright and his own director, Belasco was the one experimental hope of the theater since the death of Steele MacKaye, author of the romantic melodrama, *Paul Kauvar*, 1887. The Belasco "atmosphere" became famous. His plays were saturated with it: *Madame Butterfly*, 1900, *The Darling of the Gods*, 1902, *The Girl of the Golden West*, 1905, and *The Return of*

*Peter Grimm*, 1911, were crowded with scenic novelty. Belasco fought a bitter fight with the syndicate, and won. The true vein of realistic verity was struck in American drama by James A. Herne when he reached the writing of *Margaret Fleming*, 1890, and *Griffith Davenport*, 1899, even though his popular acceptance was through *Shore Acres*, 1892. Belasco made his stars, like Mrs. Leslie Carter and David Warfield. He reconstructed his stage with new methods of lighting. He became the archrealist, often to his undoing, since it had none of the deep basic values of Herne's realism. But he was a pioneer of revolt in this country; and America's first true experimenter in the theater. Both he and Steele MacKaye did much for the physical theater.

In those dark days of commercialism there were other bright spots. The public was on the *qui vive* for the American play. Each hopeful promise was proclaimed as the drama waited for. Cries of acclaim greeted the first performances of William Vaughan Moody's *Great Divide*, 1906, Edward Sheldon's *Salvation Nell*, 1908, Eugene Walter's *Easiest Way*, 1909, Percy MacKaye's *Scarecrow*, 1911, Benrimo and Hazleton's *Yellow Jacket*, 1912, and Langdon Mitchell's *New York Idea*, 1906. Since then the older generation, bred in the old theater, has now and again brought surprises. Owen Davis (1874- ) wrote *The Detour*, 1921, and *Icebound*, 1923, to prove that he could offer available material for one of the Pulitzer prizes, and with the latter he joined the ranks of Eugene O'Neill, Kelly, Rice, Green and Connelly. There is no more varied career than that of Mr. Davis. For he started in the 10-20-30 cent melodrama days of Al Woods with *Bertha the Sewing Machine Girl* and *Nellie the Beautiful Cloak Model*, since which time he has proven himself to be America's most prolific playwright.

Deep in the night of this dark era, seeds of revolt were being planted. The Drama League idea had spread, protesting against the neglect of the road; Prof. George P. Baker at Harvard had begun the university idea of drama study in its practical phases; the Little Theater movement was increasing rapidly. As midway between the old style manager and the extreme reformer stood such superlative men of the theater as Winthrop Ames and Arthur Hopkins. There were some who thought the situation would be improved if a repertory theater was built. The New Theater, 1909, under Mr. Ames, which opened with Julia Marlowe and E. H. Sothern in *Anthony and Cleopatra*, did creditable work, but proved nothing except that a few good plays could be well-produced despite the handicaps of timid financing and unfavorably large surroundings.

The spirit of revolt came from the Little Theaters; the Little Theaters—many of them—became semi-professional. A Provincetown wharf nurtured Eugene O'Neill, as the Neighborhood Playhouse hailed Dunsany. Young men and women with queer notions about scenery and costuming and lighting learned from art studios abroad, began tearing down the old

methods. From them the commercial theater began to hear of a group of foreign men—Appia, Reinhardt, Gordon Craig, Stanislavsky—who did not hold to traditional handicaps but forged ahead into new territory. The new era began. The drooping American theater received vital encouragement from the visits to America of Bakst and the *Ballet Russe*, of Stanislavsky and the Moscow Art Theater Company, of Jacques Copeau, of Reinhardt and of Granville-Barker. They helped to enrich the American philosophy of theater production.

The playwrights one can reckon on in novelty of theme and vitality of technique are many, outstanding among them being, Sidney Howard, author of *They Knew What They Wanted*, 1924, and *The Silver Cord*, 1926; Maxwell Anderson and Laurence Stallings who together wrote *What Price Glory*, 1924; Philip Barry, author of *Paris Bound*, 1927, and *Tomorrow and Tomorrow*, 1931; George Kelly, author of *The Show-off*, 1924, and *Craig's Wife*, 1925; Elmer Rice, who won distinction with *The Adding Machine*, 1923, and *Street Scene*, 1929; Paul Green, whose *In Abraham's Bosom*, 1926, helped to center public interest in folk drama; Marc Connelly, whose *Green Pastures*, 1930, was a triumph, and whose collaboration with George Kaufman in the writing of *Dulcy*, 1921, and *Beggar on Horseback*, 1924, brought both writers to the fore.

EUGENE O'NEILL (1888- ) is America's one marked figure, showing a vigorous originality which commands a world interest and respect. His body of dramaturgy so far has added many challenging problems to the theater. *Beyond the Horizon*, 1920, *The Emperor Jones*, 1920, *Anna Christie*, 1921, *Desire Under the Elms*, 1925, and such technically important contributions as *The Great God Brown*, 1926, *Strange Interlude*, 1928, and *Mourning Becomes Electra*, 1931, are indeed an array unequaled in the past history of the American theater.

From the Baker school at Yale, from the folk field of the University of North Carolina, under Prof. Frederick Koch, new forces are coming to drama. Through the establishment of the Theater Guild, 1919, a product of Little Theater enthusiasm, with its far-sightedness in organization, may come a rehabilitation of the "road." But the rest of the country outside New York is theater-minded to the extent that municipalities north, south, east and west have been producing their own plays in theater buildings given through voluntary and public subscription.

M. J. M.

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**AMERICAN UNIVERSITIES, THE ASSOCIATION OF**, was founded in 1900 for the purpose of making a study of matters of common interest re-

lating to graduate work. The association is composed of institutions in North America which are engaged in giving advanced or graduate instruction. Annual meetings are held at the various universities belonging to the organization. The original membership was limited to 14 universities. In 1929 this had been increased to 29.

**AMERICAN UNIVERSITY**, at Washington, D.C., a privately controlled and coeducational institution, with Methodist Episcopal affiliations. It was incorporated as a graduate school in 1891, but later was expanded to include undergraduate courses. The productive funds in 1931 were \$938,618. There are 25,000 volumes in the library. In 1931-32 there were 575 students and a faculty of 76, headed by Chancellor Lucius C. Clark.

**AMERICAN WATER COLOR PAINTING.**  
See WATER COLOR PAINTING.

**AMERICAN YEOMEN, BROTHERHOOD OF**, a fraternal, beneficiary society, organized in 1897, with the object of uniting all white men between the ages of 18 and 45 under a ritualistic lodge system. Benefits are paid to the member or their beneficiaries in case of death, accident, disability, or disease. The headquarters are at Des Moines, Iowa. Every four years there is a meeting of the governing board, known as the supreme conclave, which is administered by five directors elected at each conclave.

**AMERICA'S CUP**, an international trophy originally presented in 1851 by the Royal Yacht Squadron of Cowes, Isle of Wight, England, for a yacht race around the Isle of Wight. The race was open to all yachts and there was no time limit. The Messrs. Stevens, with two associates, sent the *America* to England to compete for the cup, a silver one valued at \$500. The *America* was a schooner of 147 tons; it beat its closest competitor by 18 minutes, completing the course in 10 hr., 37 min. In 1857 the cup was presented by its winners to the New York Yacht Club as an international yachting trophy. In 1870, 1871, 1876, 1877, 1893, 1895, the British challenged America; but on each occasion the American boat proved victorious. In 1899 Sir Thomas Lipton challenged with the *Shamrock*; but this boat was beaten by the *Columbia*. In 1901 he made another attempt with the *Shamrock II*, but was again defeated by the *Columbia*. In 1903 Lipton's *Shamrock III* lost to the *Reliance*. No further acceptable challenges were made until 1913, when Sir Thomas Lipton again came forward, this time with *Shamrock IV*. A race was organized for Sept. 1914; but the outbreak of the World War put an end to the project, although the new challenger had started on its voyage to New York. In 1920 *Shamrock IV* was beaten by the *Resolute*. Lipton challenged again in 1930 with *Shamrock V*. The British boat was beaten by the *Enterprise* in 4 races; in the first by 2 min., 40 sec.; in the second by 9 min., 49 sec.; in the third *Shamrock V* lost her mainsail; and in the fourth by 5 min., 40 sec.

**AMERICUS**, a city in southwestern Georgia, the county seat of Sumter Co., situated 71 mi. southwest



of Macon. Two railroads serve the city. The region produces principally cotton, but corn, pecans, fruit and vegetables are also grown. The city is a trade center for these products. Americus was founded in 1832, and chartered as a city in 1855. Pop. 1920, 9,010; 1930, 8,760.

**AMERICUS VESPUCIUS.** See VESPUCCI, AMERIGO.

**AMES, FISHER** (1758-1808), American statesman and publicist, was born at Dedham, Mass., Apr. 9, 1758. He was graduated from Harvard College in 1774, and seven years later was admitted to the Suffolk County bar. His early political essays revealed his interest in strengthening the federal government. He not only urged a revision of the Articles of Confederation, but as a member of the Massachusetts Convention in 1788 worked for the ratification of the proposed Constitution. In 1789-97 he served in the House of Representatives as a Federalist in support of Washington, and his speech favoring an appropriation to carry out Jay's treaty, Apr. 28, 1796, ensured its passage when the Republicans opposed it. He joined the Essex Junto opposing the French policy of President Adams, since he regarded the Gallic revolutionaries and Napoleon with distrust, and looked on England as the foundation of liberty and established religion. He opposed democracy as the rule of men who were interested merely in the acquisition of wealth and personal notoriety, thereby providing a government of the worst possible sort, ending usually in anarchy. This was the foundation of the philosophy of the New England Federalists. He died at Dedham, Mass., July 4, 1808.

**AMES, JAMES BARR** (1846-1910), American educator and legal scholar, was born at Boston, Mass., June 22, 1846. He graduated from Harvard in 1868 and from Harvard Law School in 1872. Here he became assistant professor of law in 1873, professor in 1877, and from 1895 until his death was dean. His learning and abilities had a profound influence on legal development and instruction. By teaching and writing Ames carried on and evolved the possibilities of the case method of instruction founded by Dean Langdell, and before his death this had become the usual one taught in the law schools of the country. He died at Wilton, N.H., Jan. 8, 1910.

**AMES, JOSEPH SWEETMAN** (1864- ), American physicist and educator, was born at Manchester, Vt., July 3, 1864. He was graduated from Johns Hopkins University in 1886 and received his doctorate from the same institution in 1890. Ames in 1901 was made director of the physical laboratories of Johns Hopkins, in which office he achieved scientific recognition for his researches in spectroscopy and ELECTRODYNAMICS. In 1930 he was appointed president of Johns Hopkins. He was elected an honorary member of the Royal Institution of Great Britain. His works include *Theory of Physics*, *Induction of Electric Currents* and *The Constitution of Matter*.

**AMES, OAKES** (1804-73), American industrialist, was born at Easton, Massachusetts, January 10, 1804.

He succeeded very early as a manufacturer of shovels, which were important because of the gold rush and the opening of the West. In 1863-73 he served in the House of Representatives. In 1865 he took over control of construction of the Union Pacific Railroad to connect the East with the Pacific coast. He died at North Easton, Massachusetts, May 8, 1873.

**AMES**, a city in Story Co., central Iowa, situated 30 mi. north of Des Moines. Bus lines, an electric railway and the Chicago and North Western Railroad afford transportation. There is an airport. The vicinity is a rich agricultural region, producing oats, corn and alfalfa. In 1929 the local retail business amounted to \$6,945,026. The city is an important educational center. IOWA STATE COLLEGE of Agriculture and Mechanic Arts was established here in 1869. The campus is a beautiful park, with fine buildings of Bedford stone and a campanile, the bells of which were cast in Loughborough, England. Connected with the campus are farms and laboratories for practice and experimental work of various branches of agriculture. There are also green houses, an automobile laboratory and a nursery school. The State Highway Commission has its headquarters here. Ames was founded in 1864 and incorporated in 1869. Pop. 1920, 6,270; 1930, 10,261.

**AMESBURY**, a town in Essex Co., northeastern Massachusetts, situated on the Merrimac and Powow Rivers, 43 mi. north of Boston. Transportation facilities include the Boston and Maine Railroad and bus lines. Amesbury's chief manufactures are hats, auto bodies, shoes and castings. The value of manufactured products for 1927 was \$19,250,000. The retail business in 1929 amounted to \$4,392,725. Buildings of historic and literary interest include the birthplace of Josiah Bartlett, a signer of the Declaration of Independence, and the house in which John Greenleaf Whittier, who described the surrounding region in many of his poems, lived for 56 years. The town was founded about 1664, and in 1666 was named after the English town of Amesbury. As early as 1701 Quakers made their home here. Pop. 1920, 10,036; 1930, 11,899.

**AMETHYST**, a purple or violet variety of QUARTZ which is in demand for less expensive jewelry and small ornaments. Usually it is found as well-formed, hexagonal crystals lining cavities or geodes in IGNEOUS ROCKS. The color varies in intensity and frequently is distributed unevenly, being due to either manganese or iron impurities. Heating amethysts decolorizes them; they become yellowish and then colorless. Like quartz, their chemical composition is silicon dioxide. Some varieties of clear CORUNDUM are colored amethystine by impurities, and are known as Oriental amethysts. The finest amethysts come from India, Ceylon, Persia and Brazil. Good ones are found in Madagascar, Siberia, Uruguay, Mexico and in the States of Pennsylvania, North Carolina and on the shores of Lake Superior. They also occur with fossilized wood in Yellowstone Park. See also HEXAGONAL SYSTEM; GEM STONES; GEODE.

**AMETROPIA**, imperfect refraction in the eye, causing failure to focus objects properly. When the vision is normal, parallel light rays from an object are brought to a focus upon the back part of the eye, or retina. Ametropia is present when the rays are focussed either in front of or behind the retina, causing in either case a blurring of the object. When the rays focus in front of the retina, the individual is myopic or nearsighted. In other words, objects at some distance from the eye are indistinct. When the rays focus behind the retina, the person is hyperopic or farsighted, in which case the near objects are blurred and the far objects quite distinct. The proper convex lens will correct farsightedness, while a concave lens is used for nearsightedness.

Ametropia is due to the fact that the eye is either too short or too long in proportion to the convexity of its lens. The length of the eye depends in large measure upon the shape of skull and varies in different individuals and races. Ametropia may also be brought on by disturbances or diseases of the eye. *See also* Eye; Vision.

**AM HA-ARETZ**, the people of the land. This term, which occurs in the Bible 49 times, originally signified a people residing in a particular land or locality (e.g. Genesis 23: 10; Numbers 14: 9); the Jewish people as a whole (Ezekiel 12: 19); and the mass of the people in contradistinction to the ruling class (Leviticus 4: 27; Jeremiah 1: 18). There also occur the expressions *dalat am ha-aretz*, the poorest of the people of the land (II Kings 24: 14), and *merom am ha-aretz*, the lofty people of the land (Isaiah 24: 4). In the Books of Ezra and Nehemiah *am ha-aretz* denotes mainly the heathen peoples, whom the exiles on their return from Babylonia found settled on or near Judean land and with whom some of them intermarried (Ezra 10: 2, 11; Nehemiah 10: 31, 32). During the Asmonaean period it came also to signify the native population, such as the Idumaeans and the mixed population of Northern Galilee, who during the wars of expansion of John Hyrcanus and Aristobulus, were forced to embrace Judaism (Josephus, Ant. 11: 11, 3; B. J. 1, 2, 6) or otherwise joined the Jewish people not entirely for the sake of God and remained largely ignorant of the Law and indifferent to its precepts.

As opportunity for elementary religious education was quite general in Palestine during the Tannaic period, the term *am ha-aretz* came to be applied mainly to those who willfully neglected their religious education and that of their children. The essential requirement of those who wish to order their lives in accordance with the Law is the study and the knowledge of the Torah. As Hillel (c. 20 B.C.) states: "No boor fears to sin and no *am ha-aretz* is pious." (Abot 2, 5: comp. Tosefta Berakot, 7, 18; John 7, 49.) While the *am ha-aretz* in the Talmudic literature is generally the small landowner, ignorant of the Law, neglectful of certain tenets relating to ritual cleanliness, and suspected of ignoring the laws pertaining to priestly dues and tithes, there is also the *vulgus*

who lived in the city and led an ignorant and wasteful life, void of study and good deeds and often also of useful occupation. These are also named *Yoshve Kronos*, those who sit in the corners. R. Dosa b. Harkinas (c. 40 A.D.) lists sitting "in the assemblies of *amme ha-aretz*" among the things that remove one from the world (Abot 3: 10), and references to these were made in their famous prayers (Abot R. Nathan, 16, 37b; Berakot 28b) by R. Nehunjah b. Hakana and R. Akiba, who declares that he was an *am ha-aretz* in his youth.

Social intercourse with the *am ha-aretz* was restricted. Priests and Levites, who used mainly sacerdotal food, the enjoyment of which is permitted only in the state of ritual cleanliness of food and persons, and all Israelites who observed ritual cleanliness, were forced to refrain from contact with the *am ha-aretz*, who, due mainly to ignorance (Tosefta, Ohalot 5, 17), failed to observe most of these laws. Contact with him or even his garments would communicate Levitical impurity and disqualify one from the use of priestly portion and tithes. As the *am ha-aretz*, since the days of John Hyrcanus (135-104 B.C.), was considered "untrustworthy" in the observance of the laws concerning tithing, one could not break bread at his table, and those who bought produce of the field from him, before using it had to set apart certain of the tithes required by the Law. Such products, in the land of the *am ha-aretz*, were called *demai*, or dubious.

**Characteristics of the Am ha-aretz.** Ignorance of the Law, disregard of the above mentioned precepts, a certain laxity in dealings (Abot 5, 13, "He who says: What is mine is thine and what is thine is mine is an *am ha-aretz*"), a crudity of manners at home and in public, and neglect of the education of his children, were characteristics of the *am ha-aretz* in the second and third centuries. These qualities account for the harsh statements on the part of some scholars, particularly those who resided in Sephoris during that time, concerning the *am ha-aretz*. The expressions of reciprocal hatred recorded in the Agada, often in emphatic and exaggerated language, must not, however, be taken too seriously. They are expressions of admonition and sorrow, and of heroic, though often futile, attempts to bring the *am ha-aretz* back to the study of the Torah, rather than of contempt and disdain. In some cases they may be attributed to local conditions at a particular time. (See the statement of R. Sherira, Gaon of Pumbedita, [900 A.D.], quoted in Alfasi on *Pesahim* 49b and Maimonides, *Mishna Torah*, Laws of Witness, 11: 1-5; Laws of Synhedrin 25: 1-2). While the rabbis strongly urged against marriage with an ignoramus, marriage between the *am ha-aretz* and the rest of the people was not forbidden. (See Tosefta Aboda Zara 3, 9, 11; Ketubot, 111b). As the basis of the disqualification of the *am ha-aretz* is his ignorance and neglect of the study of the Torah, great is the merit of those who teach the Torah to his children, for "from among the children of the *am ha-aretz* scholars

of the Torah will rise" (*Synhedrin* 96b). The Patriarch R. Jehuda I, editor of the *Mishna*, who was particularly bitter in his denunciation of the am ha-aretz, for their neglect of the study of the Torah (*Baba Batra* 8a), states: "He who teaches Torah to the son of an am ha-aretz, the Lord will annul for his sake every misfortune decreed." (B. M. 85a). The true attitude of the scholars toward the am ha-aretz is indicated in the following Tannaitic comment: "A man should not say: Love the pupils of the wise but hate the am ha-aretz; but, love all of these and hate only the minim, the apostates and the informers," following David who said: "Those who hate Thee, O Lord, I hate" (*Abot R. Nathan* 16, 32b; see also *Numbers Rabbah* 3, 1; comp. however, *Zohar*, Ex. 89b, 119a; *Leviticus*, 216b).

**Relative Number Small.** Though ignorant of the Law, the am ha-aretz did not represent a schism or belong to a particular sect. There were amme ha-aretz among the Sadducees (*Nidda* 34a) and the Samaritans (*Berakot* 47a) as well as among the Pharisees (*Horayot* 3, 8). The am ha-aretz represented but a small portion of the community; for the mass of the people, as Josephus (*Antiquities* XIII, 10: 6; XVIII, 1: 3) tells us, followed the Pharisees in all religious matters and were greatly influenced by them.

The suggestion of M. Sulzberger (*The Am ha-Aretz*, 1909) that am ha-aretz in the Bible often signifies "the representatives of the people," pointing to some form of parliamentary government, whose functions were determined by the political changes in the first Jewish Commonwealth, though not convincing, has been received favorably by some scholars.

B. R.

**BIBLIOGRAPHY.**—In addition to works mentioned in the text, see Buchler, *Der Galiläische Am ha-ares des 2ten Jahrhunderts*, 1906; Schurer, *Geschichte*, 113, 400 and Literature given there.

**AMHARIC**, a SEMITIC LANGUAGE of the South ARABIC group widely spoken in Abyssinia. Like Tigrē and Tigrīña, it developed from and superseded ETHIOPIA, but differs from the former two in having adopted a large number of Hamitic (see HAMITO-SEMITIC) words, in confusing and even eliminating its gutturals, and in placing the verb at the end of the sentence, as in ACCADIAN.

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**AMHERST, JEFFREY AMHERST, BARON** (1717-97), English soldier, commander of the British expedition of 1758 against the French in Canada. Previous to this he had seen much active service on the continent of Europe. He was selected by Pitt to command the expedition in Canada largely owing to his reputation for prudence and steady persistence. In 1759 Amherst was responsible for the capture of Ticonderoga and Crown Point. Ft. Niagara was also taken, while Wolfe was brilliantly successful in achieving the capture of Quebec. In recognition of his services Amherst was appointed governor-general of British North America. He now found himself at enmity with the Indians under Pontiac, and his

operations against them were considerably less successful than his previous campaign. In 1763 he was appointed Governor of Virginia. During the American War of Independence he acted as chief adviser at headquarters. In 1776 he was raised to the peerage, and in 1796 was made a field-marshal. He died at his residence Montreal in the south of England, Aug. 3, 1797.

**AMHERST**, a port and the county town of Cumberland Co., Nova Scotia, Canada. It is situated at the head of Chignecto Bay, in a coal mining and agricultural district, 138 mi. northwest of Halifax. Exports are largely engines and engine supplies, enamelware, furnaces, structural steel and various other products. A well-built town, Amherst contains the county administration buildings. Pop. 1921, 9,998; 1931, 7,450.

**AMHERST**, a town, including Amherst Village, in Hampshire Co., western central Massachusetts. The village is near the Connecticut River and 22 mi. northeast of Springfield; served by two railroads. It is the seat of AMHERST COLLEGE and the MASSACHUSETTS AGRICULTURAL COLLEGE. There are darning cotton, straw hat and leather novelty factories. Tobacco and onions are the principal crops of the neighborhood. The town was settled as early as 1731 and was a part of Hadley. It was made a district in 1759 and incorporated as a town in 1775, being named for Gen. Jeffrey Amherst. NOAH WEBSTER worked on a large part of his dictionary in this village. EMILY DICKINSON and HELEN HUNT JACKSON were born in Amherst. Pop. 1920, 5,550; 1930, 5,888.

**AMHERST COLLEGE**, a college for men, at Amherst, Mass., which was founded by Congregationalists in 1821. Though founded to prepare students for the ministry, the college later broadened its curriculum. Amherst has declined, however, to become a vocational or graduate school, and its courses lead exclusively to the degree of A.B. Two of its prominent graduates have been HENRY WARD BEECHER and CALVIN COOLIDGE. Extensively engaged in the field of foreign missions, it has been instrumental through graduates in establishing Robert College, at Constantinople; the American University, at Beirut, Syria, and the Dōshisha, in Japan. The college in 1931 enrolled 644 students, and had a teaching staff of 73 members, headed by Pres. ARTHUR STANLEY PEASE. Its productive funds amounted to \$8,615,346. The library contains 162,000 volumes. Stanley King was elected president of Amherst in Apr. 1932.

**AMICABLE NUMBERS**, also known as amiable numbers or agreeable numbers. Two positive integers are said to be amicable if each is equal to the sum of the ALIQUOT PARTS of the other. For example, 220 and 284 are amicable; for the aliquot parts of 220 are 1, 2, 4, 5, 10, 11, 20, 22, 44, 55, and 110, the sum being 284, and similarly for the other. The idea is derived from the Greek. Certain Arab and European writers asserted that talismans with the numbers 220 and 284 had the property of establishing friendship between the owners.

**AMICE**, a short linen cloth, oblong or square, which is the first to be put on by the priest when vesting for the Mass. It is used to cover the shoulders, and originally also covered the head of the celebrant. Although its origin is obscure, it seems to have been once a muffler to protect the throat. In medieval times it was turned back over the *CHASUBLE* and commonly ornamented by a strip of embroidery. Worked into the amice is a cross which the priest kisses when he assumes the vestment. See *VESTMENTS*.

**AMICIS, EDMONDO DE** (1846-1908), Italian writer and soldier, was born at Oneglia, in Liguria, Oct. 21, 1846. He served in the army and fought at the Battle of Custoza (1866). He retired from the army in 1870 and devoted himself to literature. Amicis was the author of a number of sketches of military life and several popular books describing his travels in Europe and Africa. His best known work is *Il Cuore*, written in the form of a schoolboy's journal. Amicis died at Bordighera, Mar. 12, 1908.

**AMIDES**, nitrogenous organic substances derived from *AMMONIA* by replacing one or more of its hydrogen atoms by the characteristic groups of organic acids. They have the type of formula  $R.CO.NH_2$ , the group  $CO.NH_2$  being called the amido group. *AMINES* result when the substitution is made with basic organic radicals. Amides are generally prepared by simply heating the ammonium salt (see *AMMONIUM COMPOUNDS*) of the corresponding acid, thereby producing water and the desired amide. Although crystalline solids, the amides are rather volatile, and, upon treatment with solutions of nitrous acid, are converted into the organic acids from which they were derived, with the liberation of nitrogen gas.

**AMIDINES**, organic compounds whose general formula is  $R - C \equiv (NH) - NH_2$ , where R is any organic radical. They may thus be considered as derived from ordinary *AMIDES*,  $R.CO.NH_2$ , by replacing their oxygen by the  $NH$  group. Boiling water, with a trace of alkali or acid, decomposes them into amides and *AMMONIA*.

**AMIDOPYRINE**, trade name for dimethyl-amino-antipyrine,  $C_{13}H_{17}N_3O \cdot (CH_3)_4$ ,  $C_6H_5$ , a colorless crystalline powder, also called by the proprietary name of *Pyramidon*. It is an antipyretic and analgesic, and is used in the treatment of headaches and in combination with other drugs.

**AMIEL, HENRI FREDERIC** (1821-81), Swiss philosopher and diarist, was born at Geneva, Sept. 27, 1821. He is noted for his *Journal Intime*, posthumously published in 1882-84, a work which shows a lonely soul seeking inward peace through all its endless questionings of the universe. Amiel was a professor of aesthetics and philosophy at Geneva, where he died May 11, 1881.

**AMIENS**, a town in northern France, famous for the possession of one of the world's most magnificent cathedrals, and also an important manufacturing center. Amiens was the capital of the old province of Picardy, and is now the capital of the department of

the Somme. Its manufactures are chiefly of textiles and thread, industries long famous here. During the World War the Germans occupied the town from Aug. 31 to Sept. 12, 1914, and in the spring of 1918 bombarded it, doing great damage. Nine shells fell on the cathedral, but the injuries have been repaired. Amiens was a British army center, and the cathedral contains memorials to the dead of the British Empire, and also to Americans killed in the Somme fighting. Pop. 1931, 90,211.

The Cathedral of Notre Dame at Amiens, considered by architects as the most exquisite French cathedral now existing, is almost wholly a work of the 13th century, and is marked by great unity and beauty of proportion. It was begun in 1220 and except for the side chapels and the towers was finished 50 years later, the nave and façade having been completed in 1238. The towers were added in the 13th and 14th centuries. Although the cathedral is so surrounded by houses that the first view of the exterior does not prepare the visitor for the spaciousness within, and although the towers are not as high as perfect proportion demands, the façade is awe-inspiring in its purity of design and beauty of decoration. It has three recessed porches, richly ornamented with sculpture. The 13th century figure of the Savior, called the *Beau-Dieu d'Amiens*, at the central portal, is especially noteworthy. The transept portals are also admirable.

The interior of the cathedral is beautifully proportioned, and the nave of Amiens ranks with the spires of Chartres, the façade of Rheims and the choir of Beauvais in representing the climax of French Gothic architecture. The height of the nave, 139 ft., is exceeded only at Beauvais, and the vaulting is supported by columns whose boldness and lightness enhance the soaring effect of the whole. The transepts, dating from about 1270, have the oldest tierceron vaulting known in France. In the choir, the vistas of the polygonal radiating chapels are especially charming, and the choir stalls, 1508-19, are among the best work of their period. The choir screen is adorned with colored high-reliefs of the 16th century. Although much of the old glass has been lost, a few splendid windows remain.

**AMIENS, BATTLE OF**, Aug. 8-21, 1918, a decisive Allied offensive in the *WORLD WAR*, on a front originally extending from the Amiens (Somme) sector for a distance of 23 miles southeast to Montdidier. The action continued the campaign of driving back the Germans begun in July at Château Thierry. The immediate aim of the offensive was "to disengage the Amiens-Paris railway, as well as to push back the enemy between the Somme and the Avre." Launched by the British at 4:20 A.M. on Aug. 8, the offensive engaged chiefly the British 4th and the French 1st armies, both commanded by Sir Douglas Haig. The attack was unsuspected by the 16 German battle and reserve divisions opposed to them. As at Cambrai, tanks were used to destroy machine-gun nests. The offensive moved steadily forward.

By Aug. 21 the Allies had driven the enemy back upon the Hindenburg line, and captured 40,000 prisoners and 600 guns. The German morale was badly shattered.

**AMIENS, TREATY OF**, the agreement between England, France, Spain and Holland, which was signed on Mar. 27, 1802. By this treaty, France retained her conquests in Europe, gained under the Republic, Directory and Consulate, and her influence in the republics established as a result of the late war. England retained her sea supremacy, but relinquished most of the territory conquered from her opponents, giving up Egypt, the Cape and Minorca, but retaining Trinidad and the Dutch settlements in Ceylon. Malta was to be restored to the Knights of Malta.

**AMINES**, an important group of chemical compounds, derived from AMMONIA by replacing one or more of its hydrogen atoms by a basic organic radical, an alkyl or an aryl group (see CHEMISTRY, ORGANIC). Amines are distinguished, according to the number of hydrogen atoms replaced, as primary, secondary and tertiary amines. Among the better known ones are the different methyl-amines, which are powerful bases, being much more ionized in solution than ammonia itself. Primary amines are further characterized by the exceedingly unpleasant odor produced when they react with alcoholic potash and chloroform. The amines containing aromatic radicals are much weaker bases. Phenylamine, or ANILINE,  $C_6H_5NH_2$ , is the simplest and most important, being the starting point for aniline dyes (see DYES, SYNTHETIC). Among the diamines—which contain two amino-groups and some of which are decomposition products of proteins—BENZIDINE is well known. W. J. L.

**AMISH CHURCH.** See MENNONITES.

**AMMETER**, an instrument which, when connected into an electric circuit, indicates the magnitude of the current flowing in the circuit. Ammeters are principally of the moving-coil and iron-vane types, although a few of the thermal type are employed.

Moving-coil instruments contain a small coil of wire suspended in the field of a permanent magnet (see MAGNETISM), with connections provided so that when connected into an electric circuit all or part of the current passes through the coil. Due to the introduction of this current into the magnetic field, a force is set up which tends to rotate the coil about an axis, usually in the plane of the coil itself. The turning of the coil is resisted by a spiral spring, and, in the final position taken by the coil, the force exerted by the spring exactly balances the force due to electromagnetic action (see ELECTROMAGNETISM). By proper design of the coil and field structure the amount of turning is made proportional to the current in the circuit. The current strength is read directly in amperes on a calibrated scale by means of a pointer rigidly attached to the moving coil. This type of instrument is used for the measurement of direct currents but cannot be used for measurement of alternating currents, except in conjunction with THERMOCOUPLES or RECTIFIERS.

If another coil is connected in series with the moving coil so that the magnetic field is produced by the same current as flows in the moving coil, the direction of turning of the movable coil will always be the same regardless of the direction of the current flowing in it. The instrument can then be used for the measurement of alternating, as well as direct, currents. This type of instrument is generally known as a *dynamometer*.

In the iron-vane instrument, the current passes through a coil near which is placed a vane of soft iron mounted on a shaft. Due to magnetic attraction, the iron tends to move into the coil and thus rotates the shaft against the action of a balancing spring. A pointer attached to the shaft is used to indicate on a scale the value of the current in amperes. Iron-vane instruments will operate on either alternating- or direct-current, but are not accurate in the latter case.

Thermal instruments depend for their action upon the fact that when an electric current passes through a metallic wire, heat is produced and the wire increases in length. By means of a specially designed mechanical system, the expansion of the wire operates a pointer which indicates on a scale the value of current passing through the instrument. These instruments are used principally in the measurement of currents of very high frequency. See also METERS, ELECTRIC.

W. H. T.

**AMMONIA**, a colorless gas, formula  $NH_3$ , with a pungent odor which is familiar as the aroma of smelling salts. When liquefied it boils at  $-34^\circ C.$ , and when frozen into a white crystalline solid it melts at  $-77^\circ C.$  The gas has about half the weight of air and the liquid weighs about 5 pounds to the gallon. It is very soluble in water, one volume dissolving 1,148 volumes of the gas at  $0^\circ C.$  Both the gas and its solution have alkaline properties. Liquid anhydrous ammonia can be used as a solvent. With some chemicals it forms bodies similar to hydrates, i.e.,  $CaCl_2 \cdot 8NH_3$ . Ammonia combines to form many interesting and unique compounds in which one or more of the hydrogen atoms are replaced by other elements or radicals. Some of these compounds are very important in organic synthesis.

Ammonia is liberated in connection with the putrefaction of animal matter. When horns, hides, or feathers are strongly heated, ammonia is given off—hence the name “spirits of hartshorn.” It can be obtained from its salts when they are heated with slaked lime. The ammonia of commerce is obtained by NITROGEN FIXATION and as a by-product from the production of coke, manufactured gas, etc. (See also PRESSURE REACTIONS IN INDUSTRIAL CHEMISTRY.)

Anhydrous ammonia is shipped either in small steel cylinders holding 50, 100, or 150 pounds, or in tank cars holding 50,000 pounds. Aqua ammonia, often called “A” liquor when the water solution contains 29.4%  $NH_3$ , is shipped in carboys and in tank cars. About half of our annual production of 170,000 tons is used to make NITRATES and one-quarter to am-

moniate superphosphates used as FERTILIZERS. About one-tenth is used for REFRIGERATION, its chemical and physical properties being so advantageous that it is practically the only gas so used in commercial plants. The balance of the production of ammonia is used for miscellaneous purposes, as in alkali, textile, rayon, rubber, leather and yeast manufacture, cleaning solutions, etc. Ammonia can easily be dissociated and used as a cheap source of hydrogen for welding.

In medicine, ammonia is used chiefly in the form of water of ammonia, or preferably aromatic spirits of ammonia. In small doses ammonia is a stimulant, to be used after fainting, etc. When present in large quantities, as in the bursting of ammonia pipes, it has been the cause of many deaths. G. A. P.

**AMMONITES**, a Semitic people, living in Biblical times east of Palestine and Gad. Their chief city was Rabbath Ammon, later called Philadelphia. They were descendants of Lot and Ben Ammi. The Moabites dwelt south and east of them and were closely associated with them. The language of the Ammonites was similar to the Hebrew. They were at war constantly with the Jews. Saul and David defeated them, but they were not finally conquered until the time of Judas Maccabeus. Justin Martyr speaks of them as a numerous people in his day. They worshipped MOLECH.

**AMMONIUM COMPOUNDS**, compounds containing the ammonium ( $\text{NH}_4$ ) ion. The ammonium ion behaves as an element, has a positive charge or valence of one and its chemical behavior is strikingly similar to that of the monovalent alkali metals potassium and sodium. Thus ammonium hydroxide,  $\text{NH}_4\text{OH}$ , which is formed by dissolving ammonia ( $\text{NH}_3$ ) in water ( $\text{H}_2\text{O}$ ), is a base and readily forms salts with all of the common acids. Ammonia is liberated from ammonium hydroxide or from ammonium salts by the action of stronger bases, such as, for example, sodium hydroxide (lye) and calcium hydroxide (water-slaked lime).

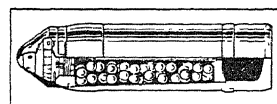
**Ammonium carbonate** is a mixture of ammonium acid carbonate ( $\text{NH}_4\text{HCO}_3$ ) and ammonium carbamate,  $\text{CO}(\text{NH}_2)\text{ONH}_4$ , occurs as white, hard mass, which on exposure to air loses both ammonia and carbon dioxide. For this reason, it is a common ingredient in smelling salts.

**Ammonium chloride** is a white crystalline powder ( $\text{NH}_4\text{Cl}$ ) formed by the interaction of ammonia or ammonium hydroxide and hydrochloric acid. Ammonium chloride is used in medicine as an expectorant, as a diuretic, and to render urine acid. In large doses it must be used cautiously.

**AMMUNITION**, all supplies containing explosives for use in connection with military or naval operations.

**Army.** Convenient classifications are grenades, bombs, small arms cartridges, artillery shrapnel and shell. Gun ammunition consists of two parts, the charge and the projectile. The charge, or cartridge, consists of a case to hold the propellant, a primer to initiate the explosion and igniter to augment the flame

of the primer and the powder, whose burning launches the projectile. The thin walls of the case are expanded against the walls of the gun by the gas pressure, preventing the escape of gas to the rear. In large cannon, the case is omitted, the powder being held in a silk bag. Escape of gas past the breech mechanism is then accomplished by split rings and gas-check pads. The projectile is called a BULLET when used in SMALL ARMS, a shot when used in cannon where its principal effect results from its weight and velocity, a SHRAPNEL if constructed to secure its effect by ejecting lead bullets upon explosion, and a shell when it secures its effect



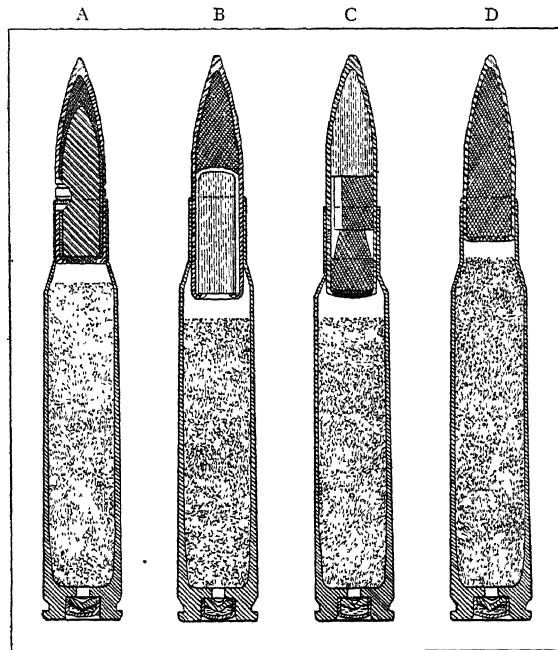
SHRAPNEL

*While the projectile is in flight, the time fuse on the nose explodes the powder, blowing the nose off and expelling the lead balls. If the time fuse fails, the percussion fuse explodes shell upon striking.*

by its fragments and explosive force. However, shell may be constructed to distribute gas, smoke or incendiary compounds, and consists of a steel case sufficiently rigid to withstand the shock of firing, an explosive charge sufficient to disrupt the case upon explosion, a fuse and primer to initiate the explosion and a booster to augment the explosive force of the primer.

C. G. M.

**Navy.** Naval ammunition is of the same general types as described above. Turret guns fire steel pro-



ANTI-AIRCRAFT MACHINE GUN CARTRIDGES, .30 CAL.

A, Armor-piercing; B, tracer; C, incendiary; D, ordinary

jectiles fitted with armor-piercing caps and with long, hollow, pointed windshields to improve flight. The bursting charge of high explosive is fired by a detonating fuse designed to burst the projectile after



penetrating ARMOR PLATE. The smaller common projectiles have thinner walls, relatively more explosive and quicker acting fuses. Antiaircraft projectiles have time fuses which, just prior to firing, are set to burst at the end of the desired flight, hits by fragments and not direct hits, being counted upon to destroy airplanes. Starshells burst at a predetermined time and illuminate the target in night firing by means of a pyrotechnic suspended from a parachute. Some projectiles carry pyrotechnic material to aid spotters by making the path of their flight visible at night. See also GUN; ORDNANCE; ARTILLERY. G. L. S.

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**AMMUNITION DEPÔTS**, centers which keep, assemble and overhaul ammunition details, but do not undertake manufacture. The Navy's reserve ammunition is stored on shore in naval ammunition depôts, one of which is located in the vicinity of each important navy yard or naval station at a distance from it where a suitably isolated tract can be found. At depôts, powder in storage is given periodical tests, cartridges and powder charges are made up, and at certain depôts projectiles are loaded with high explosives and fitted with fuses. Outside of a small number of officer personnel and the marine guards, they are operated by civilian labor. Mines are stored principally at the Navy Mine Depôt at Yorktown, Va. A large high explosive depôt at Hawthorne, Nev., consisting of many small, well-scattered buildings protected by earth embankments, is designed to take the principal part of the Navy's supply of high explosives. For this purpose a special type of storage will be used. For Army ammunition storage see ARSENAL. G. L. S.

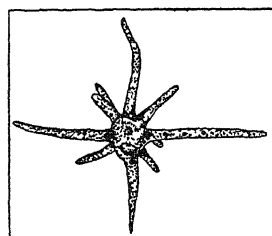
**AMMUNITION SHIPS**, vessels which accompany the fleet and carry its ammunition refills in any extensive overseas campaign and take care of routine shipments of target practice ammunition. The U.S. Navy has two such ships, the *Nitro* and the *Pyro* (each of 10,600 tons) of special design. Ammunition ships, however, are not usual in foreign navies.

**AMNESIA**, literally lack or "loss of memory." Technically, however, it is used to describe only: (1) inability to recall the events of a certain period of time, with good memory of events both before and after; (2) a temporary loss of memory. The former is the more common and arises from temporary damage to the brain by alcohol and the poisons of severe infectious diseases, by an epileptic fit, or by an injury to the head or severe shock. After a head injury there is often not only loss of memory for the time of the accident and the time immediately following it, but also for happenings shortly before the actual injury. Examples of the temporary loss are the cases of persons who may be found wandering without knowledge of their names or where they belong. Such amnesias are usually of hysterical nature. See also DISSOCIATION; PERSONALITY. H. D. S.

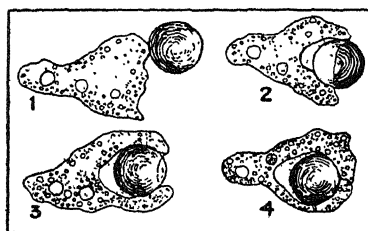
**AMNESTY**, an act of grace on the part of the sovereign of a state restoring those guilty of certain

designated crimes to the status of innocent persons, obliterating even the legal memory of the crime. In modern times it is usually carried into effect by statute rather than by executive order, save in England, Italy and the United States. In the United States the power to grant amnesty seemingly lies both with the President and with Congress. Sometimes such pardons are general, but frequently specific exceptions are made: a well-known instance of such exception was the amnesty granted by CHARLES II of England at the Stuart restoration which did not extend pardon to the regicides. The amnesty granted by the United States Congress in 1872 pardoned virtually every Confederate soldier who had taken part in the Civil War. At the close of the World War, the TREATY OF VERSAILLES excepted the German Kaiser and certain others from amnesty, and although this provision was later modified, some of the men accused were tried at Leipzig before a German Federal court. S. C. W.

**AMOEBAS**, the name for members of a class (*Sarcodina*) of one-celled animals (*Protozoa*). There are several species, some of which live in fresh or salt water, some in damp soil, while some are parasites on other animals. One of the latter (*Entamoeba histolytica*) causes amoebic dysentery. Amoebas vary in size from extremely minute microscopic forms to creatures about 3/25 in. across. It would be next to impossible to describe the shape of an amoeba, because it is rarely the same for two minutes together. The creatures move by pouring themselves along; part of the animal may be going one way, while part of it is going another. Little processes, called pseudopodia, flow out from the body here and there; some are withdrawn, becoming part of the body mass, when



AMOEBAS PROTEUS



COURTESY AMER. MUS. OF NATL. HISTORY

AMOEBAS INGESTING FOOD

1, First contact with food particle. 2, food particle partly surrounded. 3, food particle nearly surrounded. 4, food particle completely surrounded

the animal decides in which direction it will proceed.

The amoeba may be regarded as representing animal life reduced to its simplest terms. It moves; it has no mouth, but it feeds by surrounding its prey with its own substance; waste products it gets rid of,

sometimes with the aid of a contractile vacuole, sometimes by simply flowing away from them; it has no sense organs, but it is sensitive to external stimuli such as light or pressure; and it reproduces itself, usually by merely dividing into two. Both nucleus, and cell body (cytoplasm) are divided equally between the daughter cells.

**AMON**, god of Thebes, one of the chief deities of Egypt, human-headed and associated with Min, the god of Coptos. He had temples at Karnak and Luxor.

**AMORITES**, a Biblical people living in the central part of Palestine, on both sides of the Jordan in the land of Canaan. They were looked upon by the Israelites as a race of giants. Moses defeated those on the east of the Jordan and Joshua those on the west. From non-Biblical sources it is known that they came originally from the middle Euphrates. Driven from there by tribes from the north, they settled in Babylonia where they governed prosperously for 300 years, until the Hittites conquered them in 1758 B.C. They then moved to Canaan.

**AMORPHOUS STATE**, the condition of a substance when its atomic or molecular arrangement is haphazard. The antithesis is the crystalline state, where each atom or molecule is regularly and characteristically placed. Intermediate forms are the *mesomorphic states*, i.e., the *smectic*, or film-like state, where molecules are confined to one plane, but scattered at random over it, like skaters on ice; and the *nematic*, or worm-like state, where molecules are confined to a line, but are free to swing at random about this line, like keys on a rod, or to twist like beads on a string. Modern investigation has proved that many substances believed to be amorphous really consist of ultramicroscopic crystals of colloidal dimensions, as glass. See also COLLOIDS AND THE COLLOIDAL STATE; CRYSTALLOGRAPHY. J. A.

**AMORTIZATION**, a term employed to indicate the periodic—regular or irregular—writing down of the value of an ASSET. Thus, the development costs of a mine are amortized over the output of the mine; BOND DISCOUNT is amortized over the life of the bonds. See also DEPRECIATION.

**AMOS, BOOK OF**, the third of the books of the Minor Prophets in the Old Testament, is usually considered now the earliest example of the work of the prophets who committed their messages to writing. Amos, a shepherd of Tekoa, a town about 12 miles from Jerusalem, gave utterance to his judgments and visions probably between 765 and 750 B.C., in the days when Uzziah (777-36) reigned in Judah and Jeroboam II (781-41) was King in Israel. The book which bears his name, according to many modern critics, shows evidence of post-exilic editing; but in general they agree on its pure Hebrew style, simplicity of diction and finely expressed figures, which provide an unsurpassed vehicle for the impassioned judgments and ethical ideals of the prophet. An analysis of the book reveals three distinct divisions: (1) 1:2-2:16, containing judgments against the peoples of Syria and Palestine; (2) 3-6, containing dis-

courses against the northern kingdom, threatening punishment, and (3) 7-9, which gives a series of visions and explanations, ending with promises of salvation and prosperity for the faithful. The book seeks to rouse the Hebrew people from a luxurious semi-paganism to an ethical and spiritual idealism. The writer lifts up his voice in oft-quoted passages, such as, "Woe to them that are at ease in Zion;" "Hate the evil, and love the good;" "Let justice roll down as waters, and righteousness as a mighty stream."

**AMOY**, a treaty port on the island of Hai Men or Amoy, belonging to and lying off the coast of Fukien province, southeastern China. The prosperous city has a fine harbor, parks, wide roads and modern conveniences supported by natives who have made their wealth overseas in the Philippines, Malay Islands, Hawaii and other islands of the Pacific. Formerly there was a large tea trade in Amoy, but the occupation of Formosa by the Japanese has reduced the influx of the product once stored in the city for shipment. Oranges and rice, grown on the mainland of Fukien, are its chief exports. Adventure and romance have been associated with the fishermen and sailors of Amoy who have built many of the largest junks in China, plied them among the islands of the Pacific, and sailed past Formosa, the Philippines, Japan and Hawaii, to settle on the coast of the United States. Some of the most daring pirates of Chinese history have hidden in the irregular shore of the island. Amoy was one of the five ports opened to trade by the Treaty of Nanking in 1842. Pop. 300,000.

**AMPELOPSIS**, a genus of ornamental vines of the grape family, some of which are widely cultivated for their handsome foliage. There are about 25 species, natives chiefly of North America and Asia. They strongly resemble the grape in appearance and habit. Of the North American species planted for ornament the best known is the pepper vine (*A. arborea*).

**AMPÈRE, ANDRÉ MARIE** (1775-1836), French physicist, was born at Polémieux, near Lyons, Jan. 22, 1775. He was appointed professor of mathematics at the École Polytechnique, Paris, in 1809, and was elected a member of the Institute of France in 1814. Ampère is chiefly celebrated for his demonstration of the relation between electricity and magnetism, and for his pioneer work in the science of ELECTRODYNAMICS. He evolved a theory in mathematics on the basis of which he rationalized all the known electromagnetic phenomena. In addition to many scientific papers Ampère was also author of *Essai sur la philosophie des sciences*, a noteworthy speculative inquiry into the abstract aspects of science. He died at Marseille, June 10, 1836.

**AMPERE**, the practical unit of electric current. For scientific purposes it is usually defined as one-tenth of the centimeter-gram-second electromagnetic unit of current. For legal and practical purposes it is that current which, flowing through a certain silver nitrate solution, will deposit 1.118 milligrams of silver in one second (see ELECTROLYSIS).

There are three ways in which an electric current may be measured or defined; namely, in terms of its magnetic effect, its heating effect and its chemical effect. A definition in terms of its magnetic effect, like that first given above, involves the definition of certain magnetic quantities; a definition in terms of its heating effect involves the definition of other electrical quantities. The definition in terms of its chemical action does not require a knowledge of any other electric or magnetic units, and, for this reason, is more acceptable as a practical definition. Furthermore, the electrolytic method of measuring current is capable of high accuracy. *See also* ELECTRICAL UNITS. L. B. S.

**AMPERE TURNS.** *See* MAGNETIC UNITS.

**AMPHIBIAN** or amphibion, in aeronautics, a SEAPLANE or flying boat equipped with a landing gear comprising both wheels and hull or floats which enable it to land on either the ground or on water. To permit landing and taking off from water, the wheels must be raised above the waterline. The weight and air resistance of this chassis partially counterbalances the great advantages of safety and convenience inherent in an amphibian due to the myriad lakes and rivers which serve as emergency landing fields and to the fact that most cities are near water. The Loening was the first noteworthy amphibian in this country and has been widely used for exploration and military work. A four-motor, 45 passenger amphibian with a hull instead of pontoons was put into service in the fall of 1931. This ship, the "American Clipper," was the largest amphibian in the world at that time.

**AMPHIBIANS** (*Amphibia*), the class of animals which, in the animal kingdom, bridges the gap between water-living fish and land-living reptiles. A typical amphibian passes the first part of its existence in fresh water as a more or less fishlike larva, breathing by means of gills. It then changes into a land-living adult which breathes with lungs. Many adult amphibians return to the water only to deposit their eggs, and some would drown if kept submerged.

During the Carboniferous Age, amphibians were the dominant animals of the land. In those days they were comparatively large animals, and many of them wore armor. Before they had reached the climax of their development they had already given rise to the better adapted reptiles, which replaced them as rulers of the earth.

There are 1,040 living species of amphibians, the greater part of which belong to the order of frogs and toads (tailless amphibians or *Anura*). Other members of the class are the salamanders and newts, the hellbender, the mud-puppy, the congo "snake," the olm (amphibians with four legs and a tail, urodeles), the sirens (urodeles with only two legs) and the wormlike cæcilians. Several of the more obscure species, like the olm and the mud-puppy, keep their gills all their lives. These species may be regarded as permanent larvæ. The famous axolotl is interesting in this connection. Under some circumstances the axolotl never becomes an adult, but reproduces

while still a water-inhabiting larva; under other conditions it transforms into the "tiger salamander" and lives on land. Some adult amphibians never develop lungs; they breathe through their skins and the pharyngeal ends of their digestive tracts.

Living amphibians are of small size, with naked and glandular skin. The secretion from their skin gland is sometimes poisonous and generally repellent. This is their only means of defense, as there are few that can be called either powerful or active. They are usually retiring in their habits and inconspicuous in their colors. To these circumstances they may largely owe their survival, for they are less adapted to the water than fish, and cannot begin to compete with reptiles, birds and mammals on land. There are, however, notable exceptions to every generalization that can be made about them.

They live in tropical and temperate lands. Moisture, and an average temperature above 32° F. are generally essential to them, and they usually cannot endure salt water. These facts limit their distribution. Frogs, and toads are very nearly cosmopolitan. They have become adapted to many different environments. Many are terrestrial; others are permanently aquatic. Some, like, the flying frog, which wears volplanes on its feet, are arboreal. The cæcilians or blind "worms" are burrowers.

Certain species avoid the common necessity of returning to the water to deposit their eggs in very extraordinary ways. Surinam toads, for example, develop in little pockets on their mother's back, where the eggs are placed by the father. A. I. W.

**AMPHIBOLE**, a common silicate mineral, constituent of many igneous rocks. Two main varieties are recognized. The first consists principally of the metasilicates of magnesium and calcium, with small amounts of iron and manganese. These are the white, gray and pale green forms, sometimes fibrous, such as tremolite, actinolite and ASBESTOS. Nephrite, or JADE, is a white to green variety of calcium magnesium-iron amphibole which is tough, fine-grained and compact. Since prehistoric times it has been carved into ornaments, and early man sometimes made his weapons of JADE. Tremolite and actinolite are found principally in schists, gneisses and impure crystalline limestones. Asbestos is usually the actinolite variety.

The second variety is the aluminous one, common HORNBLende, containing aluminum, iron, calcium, sodium and magnesium. The color is dark green, brown or black. Hornblende is an essential constituent of diorite and is commonly found in other igneous and metamorphic rocks. It sometimes results from the alteration of the PYROXENE, augite, being known then as a secondary mineral. The decomposition of the amphiboles produces an ochre-brown earth which eventually passes into ferruginous clay.

The amphiboles crystallize in the MONOCLINIC SYSTEM. They closely resemble the pyroxenes, which are of identical composition, but of different shape. The amphiboles occur usually in comparatively long,

needle-like crystals, while the pyroxenes are chunkier in appearance. The angle between the prismatic faces or cleavage faces of the amphibole crystals is 125 and 55 degrees, while for the pyroxenes it is nearly a right angle. *See also* CHLORITE; SERPENTINE; TALC; PETROLOGY; MINERALOGY. S. F. K.

**AMPHICTYONIC LEAGUES**, associations of Hellenic city states, primarily religious in purpose. Their objects were to ameliorate difficulties between states revering the same shrine and to aid the shrine itself by protecting the sacred lands and establishing free passage for pilgrims. There was a tendency for the amphictyonic leagues to become political, as in the time of Philip II. The Delphic, the most famous of the leagues, lasted under Roman dominion until the Antonine Emperors, 2nd century, though in later years it fulfilled purely religious functions.

It was founded probably in the 8th century B.C. Before its revision by Philip of Macedon in 346 B.C., it consisted of 12 peoples, sworn not to attack each other, not to cut off the water supply in war or peace, to attack all who robbed the temple of Apollo at Delphi and all who broke the laws of this compact. The several peoples sent two voting representatives and two lobbyists each to the general meetings twice a year. The group coined money, consulted on mutual interests, both civil and religious, decided claims of one state against another and fined the offenders. This last could not be carried out against the more powerful states and moral influence was generally resorted to, sometimes with marked success. The purpose of the amphictyony was also weakened, however, because not all the states of consequence were in the league.

**AMPHION**, with his twin brother, Zethus, was the son of Zeus and Antiope. The husband of Antiope had been Lycus whose second wife, Dirce, imprisoned her rival. The boys were exposed, therefore, on Mount Cithaeron, but were reared by a shepherd. Zethus became a herdsman and hunter, while Amphion earned immortal fame as a musician. Discovering their mother in chains, the brothers seized Dirce, bound her to a bull, killed her and threw her into a well, afterward called Dirce. They then fortified Thebes. Amphion married Niobe, a daughter of TANTALUS. She bore him six sons and six daughters, so deeming herself superior to Leto who was the mother of two children only. Enraged by this presumption, Apollo slew Niobe's offspring. Amphion slew himself with a sword, and the grief of Niobe has been a favorite subject of the artist and the sculptor. Aeschylus and Sophocles wrote tragedies around the story of Niobe.

**AMPHIOXUS**, called also lancelet, the common name for members of a genus (*Branchiostoma*) of Protochordates. There are 16 species, mostly tropical and subtropical. Usually they are buried upright in the sand, with only their forward ends protruding.

Of all the animals (*Hemichordata* and *Protochordata*) which are on the border-line between vertebrates and invertebrates, amphioxus is the nearest to

the backboned animals. While it cannot be regarded as their actual ancestor, it is, nevertheless, very near the ancestral form. It somewhat resembles a small fish, some two inches long, without scales, or distinct head or paired fins. The latter are perhaps represented by two longitudinal folds, metapleures. There is a long, low, soft median dorsal fin, a caudal fin, and a ventral fin that are supported by fin rays. The segmentally arranged V-shaped muscles show clearly through the delicate skin. Most important of the features which ally amphioxus to the vertebrates are the gill-slits, which open into the pharynx, the notochord and the dorsal nerve cord. These structures are characteristic of all vertebrates; even in mammals the gill-slits appear in embryos. One pair persists as the Eustachian tubes and the notochord foreshadows the vertebral column.

**AMPHIPOLIS (YENI KEUI)**, a historic city of Macedonia, on the River Strymon, about 3 mi. from the Aegean Sea. It was first settled by Thracians, but in 437 B.C. Athenians and other Greek colonists led by Hagnon captured it. It was taken by the Spartans under Brasidas in 424 B.C. Two years later Cleon tried to retake it, but failed and both he and Brasidas were killed. It retained its independence until Philip of Macedon took possession of it in 357 B.C. and later it fell to the Romans. Under the empire the Roman governor had his residence there, and the city held an important position because of its bridge over the Strymon, which controlled the route from northern Greece to the Hellespont. Amphipolis was a distributing market for the nearby gold and silver mines and for ship timber. During the Macedonian occupancy there was a royal mint here.

**AMPHITHEATER**, originally a Roman amusement building, elliptical in plan, in which the seats for the spectators surrounded in rising tiers the central area or arena, where the gladiatorial shows or other performances took place; hence, any modern amusement building, covered or uncovered, in which the spectators' seats surround the stage or playing field. Modern sport amphitheatres are usually incorrectly called STADIUMS. The term amphitheater is also employed for a large operating room in a modern hospital, which is also used for clinical instruction. The amphitheater form was apparently first developed for the gladiatorial combats of ancient Italy. The early examples were of wood, and usually temporary; the first stone example that can be dated is the amphitheater at Pompeii, about 80 B.C. During the Empire, the building of masonry amphitheatres was exceedingly common, and there was hardly a large Roman town without one. The most interesting remains are those at Capua, 557 x 458 ft.; Pozzuoli, 482 x 383 ft.; Verona, 502 x 403 ft.; Nîmes and Arles, in France, and Pola in Istria, all of approximately similar sizes.

The most famous Roman amphitheater is, of course, the Coliseum, or Flavian Amphitheater, built by Vespasian and Titus. In size 615 x 510 ft., it probably accommodated about 50,000 spectators. The whole

building is a remarkable example of Roman ingenuity, both in planning to allow ease of entrance and exit to the vast crowds, and in structural system by which the rising seats are supported on radiating walls and vaults ingeniously contrived to form the necessary corridors and stairs. The continuous arcades surrounding the enormous ellipse have great beauty of proportion and express perfectly the construction and arrangements of the whole. The solid upper story was not added until after a fire in 217; before that, the top was of wood.

In the typical Roman amphitheater, the arena floor was raised above the ground in order to allow space for dens for the wild animals and rooms for gladiators, etc.; numerous trap doors furnished quick and dramatic entrance to the arena from below. These arrangements are well preserved in the example at Pozzuoli. The seating portion was separated from the arena by a high wall and was divided horizontally by several passageways around it, the lowest section being reserved for state officials and the like. Radial passages gave easy access to the seats, and frequent stairways or vomitory led down to the passages below and eventually to the street.

T. F. H.

**AMPHITRITE**, a goddess of the sea and wife of POSEIDON, identified by the Romans as Neptune. When Poseidon sought her she fled to ATLAS but was recovered by an emissary of the sea god Delphinus who, as a reward, was turned into a star. Among Amphitrite's children was TRITON. In works of art, the goddess shares the beauty of APHRODITE, the Roman VENUS. Her hair is enclosed in a net and claws of a crab adorn her forehead. Sometimes she rides or is drawn by marine animals.

**AMPHORA**, among the Greeks and Romans an earthen vessel of varying form, being either tall and slender or squat, but always pointed at the bottom.



COURTESY MUS. OF F. A. BOSTON

GREEK AMPHORA

Later archaic period jar by Hermonax, showing white-haired man attended by young women

It had two handles and a neck that could be sealed up with gypsum, after which a tag was attached to note the contents, usually wine, oil or honey. Because of the absence of a base, it was necessary to lean an amphora against a wall or place it in the

sand to keep it in an upright position. When it was brought to the table, the amphora rested in a holder or stand.

**AMPHOTERIC SUBSTANCES**, those which can be said to possess both basic and acidic characteristics. This duality of character may arise from either of two causes: (1) the presence in the MOLECULE of both acid and basic groups, as in the amino-acids; or (2) the ability of the molecule to behave as an acid towards strong bases or as a base towards strong acids. The latter type of amphoterism is exhibited by aluminum hydroxide which can form sodium aluminate by reaction with sodium hydroxide, or aluminum chloride by reaction with hydrochloric acid. See ALUM.

**AMPLIFICATION, THERMIONIC**, the increase in loudness of speech or music secured by means of a three-electrode electronic tube (see TUBES, ELECTRONIC); more generally, the reproduction, by means of such a tube, of any electric wave train, accompanied by an increase of energy.

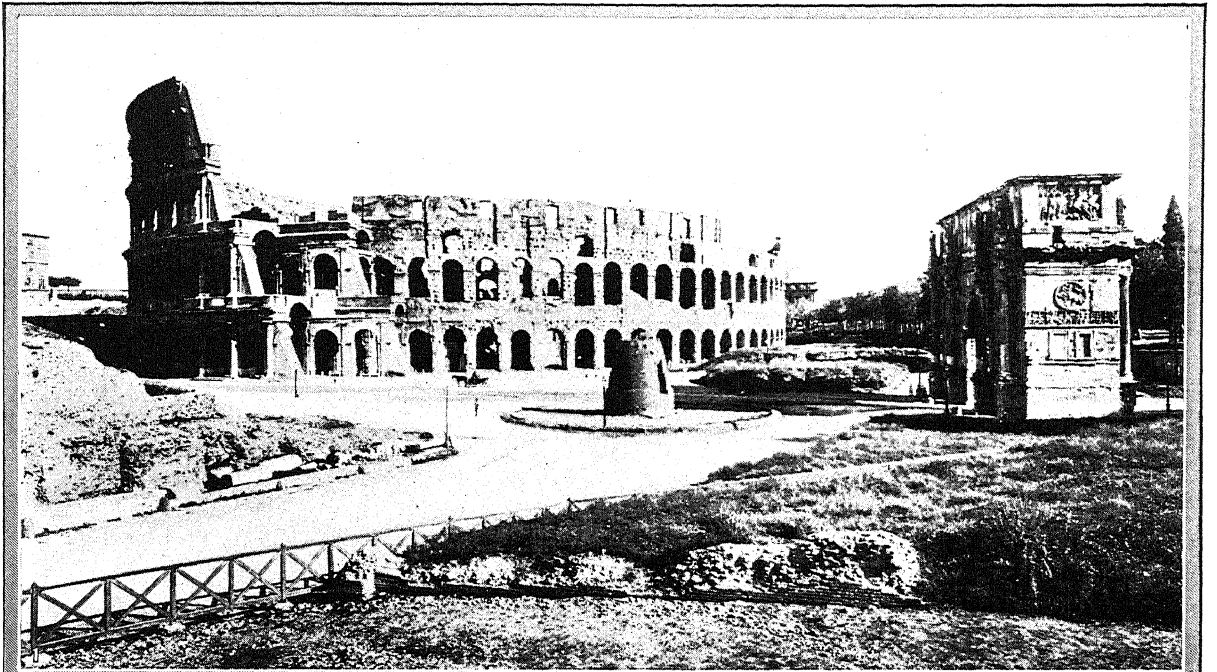
The action of an electronic tube may be described as follows: In a small glass tube are placed three terminals: a *filament*, like that of a small incandescent lamp; a *plate*, or small piece of sheet metal; and a *grid*, consisting of a bit of perforated sheet metal or wire gauze. The grid is placed between the plate and the filament, and all three terminals are attached to wires which pass through the glass walls of the tube and provide connections on the outside. The tube, when finished and exhausted of air, is permanently sealed. When in use, the filament is heated to incandescence by means of a current from a battery, termed the "A" battery, and a second, high-voltage battery, termed the "B" battery, is connected between the plate and filament. When these arrangements are complete, provided the plate is connected to the positive pole of the "B" battery, there will be a current, called the plate current, in the "B"-battery circuit. The apparent break in the circuit, the vacuum between the plate and the filament, is bridged by a stream of ELECTRONS which have been given off by the hot filament. These electrons, or thermions, are minute particles carrying free negative charges, which, because of their charges, are attracted toward the positively charged plate; the stream of electrons constitutes the plate current, or current in the "B"-battery circuit.

The rate at which the thermions are given off by the hot filament may, in large measure, be controlled by the rate at which they are carried away from the vicinity of the filament. Hence, a positive charge on the grid will increase the plate current, a negative charge on the grid will produce the opposite effect and any change in the grid charge, or grid potential, will be accompanied by a corresponding change in the plate current. Furthermore, the resulting energy fluctuations in the plate circuit may be many times as large as those in the grid circuit which have produced them; this is the effect known as amplification.

When a TELEPHONE circuit is connected to such a



## AMPHITHEATER



### THE COLISEUM AT ROME

1. Exterior of Coliseum, built in 80 A.D., nearly a third of a mile around. Arch of Constantine at the right.
2. Interior of the great theater, showing tier arrangement for seats. In the lower walls were dens for wild beasts.





tube so as to cause, by the fluctuating voice currents, variations in the charge, or potential, of the grid, these fluctuations, many times magnified, will be reproduced in the plate circuit and in any receiving circuit connected with it. L. B. S.

**AMPLITUDE.** See VIBRATORY MOTION.

**AMPULLA**, a vessel for holding oil or perfume, originally used for toilet or burial. In the Catholic Church, it contains the blessed oil or chrism, consecrated by the bishop and used in confirmation, ordination, Extreme Unction, and in consecrating sacred vessels. The ampulla used at coronations in Westminster Abbey, designed as an eagle, is a venerable object of great antiquity. The noted pre-Revolutionary ampulla at Reims was a dove that, according to tradition, descended from heaven when Clovis was crowned.

**AMPUTATION**, cutting off a limb, or a part of a limb, the breast or other projecting part of the body. Amputation of a limb is performed because of death of the part as a result of a wound or due to infection. Tumors, such as sarcoma, affecting one of the bones of the leg or arm, necessitate amputation. Various types of operations have been devised, such as circular amputation and coat-sleeve amputation, depending upon the arrangement of the flaps to cover the raw area. Other types have been named after operators such as Chopart's and Lisfranc's.

**AMRAM**, famous in Scripture as the father of AARON and MOSES. The Book of Exodus states that "Amram took him Jochebud, his father's sister, to wife . . . and his years were 137." Little else is known of him, and it is a moot point among scholars whether Amram was a person or a clan. The name was also borne by the head of the Jewish Academy at Swia in Persia who, in the 9th century, produced the first complete liturgy for the synagogue. The *Siddur Rah Amram*, published at Warsaw, 1865, is the main source of Jewish ritual. Amram died in 875.

**AMRITSAR**, a city of British India noted for its wealth and its being the center of the Sikh religion. The Golden Temple at which the Sikhs worship enshrines the Granth, or sacred book of the Sikhs, together with other treasures. Instruction in Sikhism is provided at the Sikh College. Pop. 1921, 160,218.

**AMSTERDAM**, the largest city of the NETHERLANDS and that country's legislative capital and commercial, industrial and financial center, deriving its name from a dam built in 1240 across the river Amstel. The greatest development of the city followed the TREATY OF WESTPHALIA, which crippled the commerce of its rival, Antwerp. Amsterdam is built on about 90 islands, and is intersected by four large canals and many smaller ones. It has 300 bridges. The general form of the picturesque city is semi-circular, presenting odd contrasts of quiet old-fashioned streets, tree-lined along waterways, adjoining busy modern thoroughfares. The city has a number of interesting buildings, of which one of the outstanding is the Ryksmuseum, one of the finest

art museums in the world. The museum contains many notable paintings by Dutch and Flemish artists, including Rembrandt's *Night Watch*. The Jan Six Collection fills another noteworthy museum of 17th century Dutch painting. Amsterdam is internationally famous for its diamond-cutting. Sugar-refining, distilling, gold and silver work are also important. As one of the foremost financial institutions of Europe, it is the seat of the Bank of the Netherlands. The philosopher SPINOZA was born in the foreign quarter of the city in 1632, and REMBRANDT lived here in 1640-56. Amsterdam is a busy airport on the routes joining London, Paris and Berlin. Pop. 1930, 759,286.

**AMSTERDAM**, a city of eastern New York State, in Montgomery Co., situated on the Mohawk River, over 30 mi. northwest of Albany. It is served by the New York Central and the West Shore railroads, bus lines and the State Barge Canal. The surrounding hills rise as high as 380 ft. above the river. Amsterdam ranks among the world's chief manufacturing centers in the production of carpets, rugs, brooms and fresh-water pearl buttons. Other leading manufactures are knit goods, gloves, hosiery and silk and rayon underwear. In 1929 the total value of manufactures was \$51,655,835. The retail business in 1929 amounted to \$17,699,050.

The site of Amsterdam once belonged to the Mohican tribe of Algonquin Indians, but the Mohawk tribe of Iroquois drove them out before 1600. In 1775 Aaron Vedder built here a small grist-mill, the beginning of the town. Settlers flocked to the site after the Revolution, calling the village Veddersburg. In 1804 Amsterdam was named after the ancestral home of many of its pioneers. The town was incorporated in 1831; the city in 1885. Pop. 1920, 33,524; 1930, 34,817.

**AMSTERDAM or NEW AMSTERDAM**, an extinct volcanic island in the Indian Ocean, about 60 mi. from St. Paul Island. It was discovered by Anthony Van Diemen in 1633 and annexed by France some 260 years later. The island is uninhabited, although at times shipwrecked sailors have been forced to seek refuge there. The surrounding waters furnish cod and seal to fishermen from the island of Réunion.

**AMSTERDAM SHIP CANAL (NORTH SEA CANAL)**, a short waterway connecting Amsterdam with an artificial harbor on the North Sea. It was begun in 1865 and completed in 1876 at a cost of about \$13,000,000. The canal separates the peninsula of North Holland from the remainder of Holland, passing through Lake Y and Wyker Meer, with an excavated passage, 3 mi. long, between Velsen and the North Sea. The canal is 16½ mi. in length. The water level is maintained at 14 in. above low water mark in the North Sea, and locks at either end of the canal supply adequate control.

**AMU-DARYA**, a river of central Asia. It rises in the plateau of Pamir, near the eastern border of Turkestan, and flows west to 66° E. long. and northwest, emptying on the south side of the Aral Sea.

The river is about 1,700 mi. long and navigable for about 800 mi. In ancient times it was called the Oxus.

**AMULET**, an object worn on the person to protect against evil. Precious stones, metals, objects of peculiar shape, or objects associated with beliefs in their power, such as a rabbit's foot, an elk's tooth, a lock of hair, rings, combs, almost anything could serve as an amulet. Special amulets to offset specific diseases were prepared; a ring against cramps, a tooth from a corpse against toothache, elder against epilepsy, the root of vervain or a toad against scrotula, and so on.

In primitive folk-lore amulets are rather simple objects to which special virtue is attached by reason of beliefs resting on analogy. Amulets reflect the elaboration of superstitions as they grow side by side with religious systems, with medical practice, with the survivals of folk-lore beliefs. The rituals of amulets is as rich as the superstitious and magical forces from which their virtue derives.

**AMUNDSEN, ROALD** (1872-1928), Norwegian polar explorer, born in Borge, Norway, July 16, 1872. He was graduated from Oslo (then Christiania) in 1890 and studied medicine for a time. In 1894 he entered the navy as a second lieutenant. In 1897-99 he was in command of the ship of the Belgica polar expedition. In an Arctic expedition in 1903-06 he discovered the position of the magnetic North Pole and navigated the Northwest Passage. In 1910-12 he led an expedition to the Antarctic and reached the South Pole, Dec. 14, 1911, the first man to accomplish this. After three failures to reach the North Pole he succeeded in the dirigible "Norge," leaving Spitsbergen, May 11, 1926, circling the Pole, crossing the Arctic basin, and arriving at Teller, Alaska, May 14. On June 17, 1928, he left Spitsbergen by plane to search for General Nobile in the North Polar region, and apparently was lost.

**AMUR RIVER**, the principal river of eastern Siberia. The Amur is formed by the junction, on the Mongolian Plateau, of the Shilka and Argun rivers. From this point it flows in a general easterly direction meeting the Ussuri River and then turning northeast to empty into the Gulf of Tartary. It forms, up to its junction with the Ussuri, the northern border of Manchuria. The Amur is 2,920 mi. long, and is navigable by shallow-draft steam vessels for some 200 mi. and by junks for 1,500 mi. It is an important means of transport for the products of eastern Siberia, particularly for the lumber which is floated down in huge rafts. The Chinese name for the Amur is Heilung Kiang, or Black Dragon River, from the color of the water.

**AMYGDALIN**, a glucoside,  $C_{20}H_{27}NO_{11} \cdot 3H_2O$ , crystalline in form, occurring in the kernel of bitter almonds and certain other plants. It is extracted from almond cake with boiling alcohol. Amygdalin has a slightly bitter taste but is not poisonous. Its aqueous solution, mixed with emulsin, decomposes, yielding HYDROCYANIC ACID and bitter-almond oil (see BENZALDEHYDE).

**AMYGDULE**, small cavities of the shape and size of almonds, found in some igneous rocks, usually Lava flows. They are due to the expansion of entrapped gas as the rock solidifies. Frequently these cavities are later filled with minerals, as CALCITE or ZEOLITE, by precipitation from circulation waters. See also GEODE.

**AMYL ACETATE**, a colorless liquid ester, having a pear-like odor and the chemical formula  $C_5H_{11} \cdot C_2H_3O_2$ . It boils at  $145^\circ C$ . and has a specific gravity of 0.870-0.875. It is manufactured from amyl alcohols, using either fusel oil or that produced by one of the synthetic processes. A mixture of the alcohols with acetic acid is refluxed in the presence of sulphuric acid or other suitable catalyst. When the reaction is completed, the crude ester, still containing unconverted alcohol, is neutralized and distilled.

Amyl acetate finds its greatest use as a solvent for NITROCELLULOSE. For this purpose LACQUERS use by far the greatest amount. Other nitrocellulose products using the acetate are photographic and motion picture films, waterproofing varnishes, bronzing liquids, artificial leather, celluloid and celluloid cement. Amyl acetate is also used in flavoring essences and perfumes, and as a chemical reagent. L. H. C.

**AMYL ALCOHOLS**, liquid organic compounds having the formula  $C_5H_{11}OH$ . Amyl alcohols are produced, (1) as by-products in the manufacture of ethyl alcohol by fermentation of grains, molasses, beet roots and other starch or sugar containing materials, and (2) by synthesis in several chemical processes.

Prior to 1926, the fusel oil obtained in the fermentation process was the important source of amyl alcohols. Fusel oil consists principally of two primary amyl alcohols, namely, secondary butyl carbinol, or active amyl alcohol, and isobutyl carbinol also known as isoamyl alcohol. Other alcohols of lesser and greater molecular weight are also present.

To-day, the supply of amyl alcohols is derived from chemical synthesis. The most important process is the following: Casinghead gasoline is fractionally distilled to obtain a portion consisting of iso- and normal pentane. This portion is chlorinated in the vapor phase. The resulting chlorinated products are fractionated to isolate the monochloropentanes. These are hydrolyzed in the presence of caustic soda to produce a crude mixture of the amyl alcohols, with unconverted amyl chlorides and amylene. Further purification by distillation yields a mixture of pure amyl alcohols, free from chlorides and amylene. In addition to the two amyl alcohols present in fusel oil, this alcohol mixture contains four others, namely, tertiary amyl alcohol, diethyl carbinol, methyl propyl carbinol and normal butyl carbinol. It is free from the alcohols of higher and lower molecular weight usually present in fusel oil.

An additional source of diethyl carbinol, methyl propyl carbinol and tertiary alcohols is the hydration of amylenes. The unsaturated hydrocarbons are produced as by-products in the chlorination process or in cracking of other hydrocarbons for production of

gasoline and other similar processes. The unsaturated amylenes are absorbed in strong sulphuric acid and then converted to the alcohols by the addition of water.

The chief use of the various mixtures of amyl alcohols is in the formulation of nitrocellulose lacquers (*see* NITROCELLULOSE; LACQUERS). At least half of the total production is converted to the corresponding acetates to be used in the same way.

Close-boiling fractions of the individual alcohols separated from the mixtures are in demand for the synthesis of other chemical and pharmaceutical products. Both the mixtures and individual alcohols are used in flavoring extracts, essences and perfumes, as reagents in dry cleaning, as solvents and as chemical reagents. L. H. C.

**AMYLASE.** *See* CARBOHYDRATES.

**AMYL NITRITE**, a clear yellowish liquid ( $C_5H_{11}NO_2$ ), having a peculiar ethereal, fruity odor, whose chief use in medicine is the dilatation of the blood vessels and hence a concomitant fall in blood pressure.

**AMYLOID**, an organic substance deposited between the cells in various organs of the body, as a result of diseases which are accompanied by tissue destruction. This occurs especially in the liver, spleen, kidneys, suprarenal glands, inner wall of the stomach and lymph glands. The deposits are colorless, translucent proteids, and may be seen microscopically in tissue framework of most of the diseased viscera in some cases of tuberculosis, especially of the bones, bone abscess, suppurative osteomyelitis, syphilis, malaria, and dysentery. In these conditions protein-split products from destroyed tissue circulate in the blood. Escaping through the walls of the capillaries, they are changed to a gel, and are precipitated in insoluble form.

**AMYOT, JACQUES** (1513-93), French prelate and author, was born at Melun, Oct. 30, 1513. He is most famous for his rendition into French of the *Lives* of Plutarch, which, when translated into English by North, had an enormous influence on Shakespeare. Among his other translations was one of Longus's *Daphnis and Chloe*. Amyot acted as tutor to the sons of Henry II, held various official positions, and was made Bishop of Auxerre by Pope Pius I. He died Feb. 6, 1593, at his see.

**ANABAPTISTS**, a name applied by their opponents to those Christian sects which reject the baptism of infants, considering as valid only that of adults. The term, however, since it means rebaptized, is repudiated by those who deny infant baptism. Historically it is applied to a sect of religious fanatics which arose in Germany in the 16th century under the leadership of Thomas Münzer. The doctrines of this sect, in addition to those relative to baptism, included community of possessions, a belief certain to attract the adherence of many who possessed nothing. In 1525 a violent insurrection broke out, leading to severe measures of repression. The insurrection was crushed in 1535 by an alliance of Protestant

princes and the bishop-prince of Münster, which city was the scene of the most extravagant excesses of the fanatics.

**ANABASIS**, the title of a work by the Athenian soldier of fortune, Xenophon, who was one of 10,000 Greek troops hired by Cyrus in his effort to gain the Persian throne. Cyrus's Oriental troops were beaten, 401 B.C., at Cunaxa; the Greeks, led at times by Xenophon, found their way through thousands of miles of hostile country to the Black Sea. Xenophon's account of this expedition, noted for its charm and originality, demonstrated the feasibility of an attack on Asia Minor, and is thought to have influenced ALEXANDER to attempt his conquest of Persia. In the 2nd century A.D. Arrian wrote an *Anabasis* concerning Alexander's exploits.

**ANACONDA** (*Eunectes murinus*), an aquatic constrictor, one of the largest snakes of the Boa family, sometimes attaining a length of 20 to 30 ft. It is dark olive-brown in color, with large dark dorsal spots, and smaller lateral spots of light color. The under side is whitish, spotted with black. Instead of being covered with scales, its snout has shields which can be closed under water. The anaconda inhabits the swamps and rivers of South America, where it combines an arboreal and aquatic life. It may submerge itself in the water, with only a small part of its head showing, or lie stretched out on an over-hanging branch. It preys on the birds and mammals that live in the water or that come to drink. Although strong enough to crush large animals, the anaconda feeds chiefly on small mammals and aquatic birds. Unlike the other large boas, it is decidedly ill-tempered. The female produces her young alive, at long intervals and in varying numbers, but few of which survive to attain full growth. *See* PYTHON.

**ANACONDA**, a city in southwestern Montana, the county seat of Deer Lodge Co., situated 25 mi. northwest of Butte, in a copper mining region. It is served by bus lines and the Butte, Anaconda and Pacific Railroad. There is an airport. Anaconda was founded by the Anaconda Mining Co., in 1884, selected as a suitable place for a copper smelting plant on account of the abundant water supply. In 1892 and 1902 the company erected new equipment and increased the production of copper to a quantity equal to about 10% of the world's production. In 1929 the industrial output was worth approximately \$600,000; the retail trade amounted to \$7,320,472. Other minerals, such as lead, zinc and manganese, are also treated. This region has hot springs and State forests. Anaconda was incorporated in 1887. Pop. 1920, 11,668; 1930, 12,494.

**ANACORTES**, a port city in northwestern Washington, in Skagit Co., situated on Fidalgo Island, in Puget Sound, 15 mi. southwest of Bellingham. Steamships, ferries and the Great Northern Railroad afford transportation. The leading industries are fishing, canneries and cod fish plants. The city is a market for lumber, especially fir and cedar from Canada, and for fruit and plants. There are lumber,

shingle, pulp and box shoo mills. Anacortes is surrounded by magnificent scenery, evergreen forests and salt and fresh water fishing grounds. It is the marine gateway to the beautiful San Juan Islands. Six mi. south is Deception Pass State Park. Some distance southwest is Mt. Olympus National Monument. Pop. 1920, 5,284; 1930, 6,564.

**ANACREON** (c. 560-475 B.C.), Greek poet, was born at Teos, Asia Minor, about 560 B.C. A writer of beautiful and often boisterous songs, his poetry is known to-day only from fragments and from the praises of Greek writers. He was a son of the brilliant period of culture which flourished on the Greek coast of Asia Minor, before the great Age of Athens, and which gave the world poets like SAPPHO and Alcaeus.



ANACREON

On account of the Persian invasion Anacreon fled from his birthplace, Teos, to Abdera in Thrace, east of Salonica, where he wrote many convivial songs. But he soon found his way back to Samos, where he became a favorite at the court of Polycrates, then the foremost man in the Greek world. When his patron died, Anacreon was welcomed to Athens by Hipparchus. When Hipparchus was killed, the poet went back to his native Teos, where he died at the age of 85, and where he was buried. He has given

his name to a class of rollicking, jovial songs, and had no equals in the rich variety of his verses and the purity of his diction. He had many imitators through the centuries. The Greek verses extolling lovemaking and jollity which bear Anacreon's name and were charmingly translated by THOMAS MOORE are perhaps not really by the great song-writer of Teos, though they are observed to follow his tradition. *See also GREEK LITERATURE.*

**ANADARKO**, a city and the county seat of Caddo Co., situated in southwestern Oklahoma on the Ouachita River, about 50 mi. southwest of Oklahoma City. Two railroads serve the city. The surrounding region is fertile and produces cotton, grain, vegetables and fruit. The principal industries are cotton, oil and flour milling, and the handling of grain for elevators. Two United States Government Indian schools are located here. Pop. 1920, 3,116; 1930, 5,036.

**ANAEROBIC BACTERIA.** *See* BACTERIA.

**ANAGNIA**, the modern Anagni, a town of southern Italy in ancient Latium southeast of Rome. The most important city of the old Hernici, it was the seat of their assembly. Later, in the 4th century, it became a Roman prefecture. Anagni has an 11th century cathedral in Gothic style which is still standing. Four popes were born in the town and it was the scene of the death of Pope Adrian IV.

**ANAHEIM**, a city in Orange Co., southern California, situated 28 mi. southeast of Los Angeles. The Atchison, Topeka and Santa Fé, Los Angeles and

Salt Lake and Southern Pacific and Union Pacific railroads and bus lines provide transportation. The countryside produces chiefly citrus fruits and walnuts, but there are dairy, poultry and truck farms also. There are some manufactures, including canned and dried fruits, beet sugar, commercial alcohol and citrus machinery. Anaheim has a beautiful recreation park with a swimming pool, ball grounds electrically lighted at night and a concrete outdoor theater, municipally-operated, which seats 2,500. Anaheim was founded in 1857 when 50 German families from San Francisco settled on the site, planning to run it on the cooperative basis. The communistic idea broke down when the tract of land was divided into shares. Pop. 1920, 5,526; 1930, 10,995.

**ANALGESIA**, or loss of sensibility to pain, which may be produced by the action of drugs such as the coal-tar derivatives, including acetylsalicylic acid and antipyrine, as well as by the narcotics. It occurs also in nervous disorders which are unaccompanied by tissue changes, such as hysteria, and diseases which injure nervous tissue, as apoplexy.

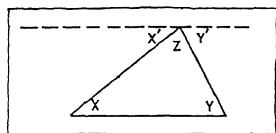
**ANALOGY**, a form of argument based on comparison. From things similar in some respects further comparisons are made on the basis of these resemblances. Thus it has long been customary to think of society in terms of an organism. The organic analogy has not only been used as a rhetorical device but has been taken as a serious hypothesis by many prominent thinkers. This analogy is formed by pointing out the similarities and dissimilarities of society to an individual organism.

A resemblance may be only superficial, and the test of an analogy is whether it holds at essential points. Society may have parts which correspond to those of an organism, such as transmission centers and specialization of function, but is there anything in society which corresponds to individual consciousness or individual purpose? If not, the analogy breaks at one of the essential points. Argument from analogy is dangerous. Often it may be clever, but careful examination must be given it before its conclusions are accepted.

**ANALYSIS**, the process of breaking up into parts, the opposite of synthesis. Analysis tears down; synthesis builds up. Obviously these processes are not separate and independent of each other. Like deduction and induction they are complementary processes. Analysis is sometimes said to be inductive, synthesis deductive.

Analysis starts with a whole and analyzes it into its parts. Since wholes are sometimes more than the sum of their constituent parts, it is often claimed that analysis is not the correct method of procedure. Such a position is taken by HENRI BERGSON, who maintains that analysis tends to distort reality. The neorealists, although admitting the holistic principle (*see HOLISM*), nevertheless insist on the integrity of an intellectual analysis. In reply to Bergson they show that it is only a false analysis that destroys, and that a correct one enables the intellect to arrive at truth.

**ANALYSIS**, in mathematics, a term variously used by the ancient and modern mathematicians. The Greek geometers used it in such lines of reasoning as this: I can prove  $A$  if I can prove  $B$ ; I can prove  $B$  if I can prove  $C$ ; but I can prove  $C$ , and hence I can prove  $A$ . It is used in this sense in discovering a method of proof in elementary geometry to-day, in contrast to the synthetic method of stating proofs that appear in textbooks. For example, let it be required



to prove that the sum of the angles  $x, y, z$  of a triangle is equal to two right angles. Since  $x' + z + y'$  is equal to two right angles, I can prove the proposition if I can prove that

$x = x'$  and  $y = y'$ . But I have already proved this. Hence I can prove the given theorem. We now reverse this, beginning with  $x = x', y = y'$ , hence  $x + y + z = x' + y' + z$ , and this already has been proved equal to two right angles,—this being the synthetic proof. The term has in modern times come to be applied to lines of reasoning in which algebra is extensively used, as in **ANALYTIC GEOMETRY**, and in higher analysis, and is considered as including such branches as function theory, the calculus, analysis situs and others.

**ANALYSIS, CHEMICAL:** Gravimetric, Inorganic, Organic, Qualitative, Quantitative, Volumetric. See **CHEMISTRY**; Analytical Chemistry.

**ANALYTICAL MECHANICS.** See **MECHANICS**.

**ANALYTIC GEOMETRY.** A considerable number of propositions in **GEOMETRY** may be formulated algebraically. Such are the propositions concerning areas or volumes, as in the case of the famous Theorem of Pythagoras (see **PYTHAGOREAN THEOREM**). On this account many geometric problems are solved by means of **ALGEBRA**. However, it is possible to go much farther in this direction. In fact, all geometric theorems may be proved by means of algebra and all geometric figures may be studied by algebraic methods. This constitutes the object of Analytic Geometry.

**Coordinates of a Point.** When we wish to indicate a point on the surface of the earth where no landmarks are available, we make use of the longitude and the latitude of the point. A similar scheme may be used to designate a point in the plane. For the equator and the first meridian we take two perpendicular lines  $OX, OY$ , at our convenience, called the  $x$  axis and the  $y$  axis respectively (Fig. 1). Their common point  $O$  is called the origin. If  $P$  is any point in the plane and  $Q, R$  the feet of the perpendiculars from  $P$  upon  $OX, OY$ , we may measure, with any convenient unit, the segments  $OQ, OR$ . The results  $x, y$  of these measurements are called the coordinates of the point  $P$ .

To avoid all ambiguity we say that  $x$  is positive if  $Q$  lies to the right of  $O$ , and  $x$  is negative when  $Q$  lies to the left of  $O$ . Similarly  $y$  is positive or negative according to whether  $R$  falls above or below the origin  $O$ . These conventions correspond to the des-

ignations of "east" and "west," or "north" and "south," in connection with longitudes and latitudes.

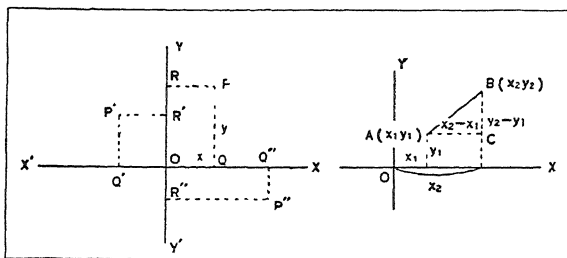


FIG. 1

FIG. 2

It is clear that a given point has only one pair of coordinates, and, conversely, given the coordinates, the point may be located in the plane without ambiguity. We have thus a sort of duality in which a point and a pair of numbers are the equivalent of one another. This correspondence has the remarkable consequence that all the geometric operations on points may be duplicated by algebraic operations on pairs of numbers.

**Distance Between Two Points.** If two points are given geometrically, that is, if they are marked in the plane, we can measure their distance apart. If the same two points  $A, B$  (Fig. 2) are given analytically, that is, if we know the coordinates  $(x_1, y_1), (x_2, y_2)$  of these points, we can find an algebraic expression for the length of  $AB$ . In the right triangle  $ABC$  we have  $AC = x_2 - x_1, BC = y_2 - y_1$ , hence

$$\overline{AB}^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2. \quad (a)$$

**Illustrative Problem.** Construct a circle passing through two given points and tangent to a given line.

We can enlist the help of analytic geometry to find the center of the required circle. Let us take the given line for the  $x$  axis and any line perpendicular to it for the  $y$  axis. Let  $A, B$  (Fig. 3) be the given points. Their coordinates  $(x_1, y_1), (x_2, y_2)$  are known. Let  $(x, y)$  be the unknown coordinates of the required center  $C$ . Since the circle is to be tangent to the  $x$  axis, the distance  $y$  from  $C$  to this line is the length of the radius. But, by formula (a), the distances  $CA$  and  $CB$  are  $CA = \sqrt{(x - x_1)^2 + (y - y_1)^2}, CB = \sqrt{(x - x_2)^2 + (y - y_2)^2}$ , and each is also equal to the radius of the required circle; hence

$$\begin{aligned} (x - x_1)^2 + (y - y_1)^2 &= r^2 \\ (x - x_2)^2 + (y - y_2)^2 &= r^2. \end{aligned}$$

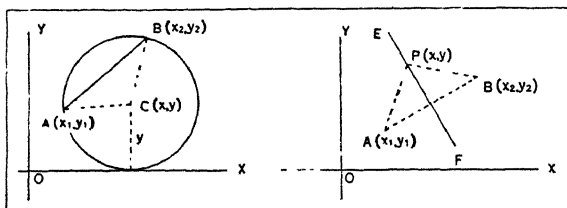


FIG. 3

FIG. 4

If we solve these two equations simultaneously for  $x$  and  $y$ , we have the coordinates of the required center. With this point located, the circle is drawn



**Equation of a Straight Line.** Consider now that in addition to  $A, B$ , we have a third point  $P$  (Fig. 4) with coordinates  $x, y$ . We have, according to formula (a),

$$\begin{aligned} \overline{PA}^2 &= (x - x_1)^2 + (y - y_1)^2, \\ \overline{PB}^2 &= (x - x_2)^2 + (y - y_2)^2. \end{aligned}$$

If  $P$  is a point on the perpendicular bisector of  $AB$ , we have  $PA = PB$ , and therefore also

$$(x - x_1)^2 + (y - y_1)^2 = (x - x_2)^2 + (y - y_2)^2. \quad (b)$$

But if  $P$  is not on the perpendicular bisector  $EF$  of  $AB$ , the equality (b) does not hold. We have thus a surprising correlation between the line  $EF$  and the equation (b): if a point lies on  $EF$ , its coordinates will satisfy (b), and if the point does not lie on  $EF$  its coordinates do not satisfy (b). This intimate connection between the geometric line and the algebraic equation is expressed by the statement that "the line  $EF$  has (b) for its equation," or "(b) is the equation of  $EF$ ."

The equation (b) when simplified may be put in the form

$$2(x_1 - x_2)x + 2(y_1 - y_2)y - (x_1^2 - x_2^2 + y_1^2 - y_2^2) = 0. \quad (c)$$

In this equation  $x_1, x_2, y_1, y_2$ , are given numbers and  $x, y$  are the coordinates of any point, or, which is the same thing, of a variable point of  $EF$ . This equation is of the general type

$$Ax + By + C = 0. \quad (d)$$

It is important to notice that this equation is of the first degree in  $x$  and  $y$ . Furthermore it may be proved that the equation of any straight line is of the type (d).

**Plotting an Equation.** Given an equation of the first degree in  $x$  and  $y$ , say

$$2x + 3y = 8,$$

we may assign to  $x$  an arbitrary value, say,  $x = 1$ , and solve the resulting equation  $2 + 3y = 8$  for  $y$ . We find that  $y = 2$ . We may interpret (1,2) as being the coordinates of a point with reference to a given set of axes. We may repeat the same operation for, say,  $x = -2$ , and plot the resulting point  $(-2, 4)$ , and so on. We may thus derive from the equation as many points as we wish. Now all these points will turn out to lie on a straight line, and it may be shown that this will inevitably be the case, whenever the equation is of the first degree in  $x$  and  $y$ . Hence the term *linear* is used to designate equations of the first degree.

The above method may be applied to plot the equation of any degree in  $x$  and  $y$ , as

$$xy + x - 3 = 0, \quad x^3 - 2y^2 + 5x = 0,$$

etc. We then obtain CURVES of various degrees.

Thus any algebraic equation in two variables may be represented by a curve, taking straight lines as special cases.

The case of two simultaneous equations may be illustrated as follows: Given two straight lines, we may construct their point of intersection. If the two lines are given analytically, that is by their equations, we can determine their common point algebraically. Indeed, since the point lies on both lines, its coordinates must satisfy both equations, and hence these coordinates may be found by solving the two equations simultaneously.

As an illustration, the perpendicular bisectors of the sides of a triangle pass through the same point.

For the sake of illustration we shall prove this theorem analytically. Let  $ABC$  be the given triangle. Draw two coordinate axes, and let  $(x_1, y_1), (x_2, y_2), (x_3, y_3)$  be the coordinates of  $A, B, C$ , with respect to these axes. By a method already explained we may find the equations of the perpendicular bisectors of the segments  $AB, BC, CA$ . If we solve the first two of these equations simultaneously, we find the coordinates of their common point, and in order to prove the proposition, it suffices to verify the equation of the third perpendicular bisector. Actual calculations show that the supposition is correct.

As a further illustration, let  $F$  be the center of a circle of radius  $r$ . If  $(a, b)$  are the coordinates of  $F$ , and  $(x, y)$  those of any point  $M$  in the plane, we have, by (a),

$$(x - a)^2 + (y - b)^2 = \overline{FM}^2.$$

Now if  $M$  is on the circumference of the circle, we have

$$(x - a)^2 + (y - b)^2 = r^2, \quad (e)$$

but this equality does not hold if  $M$  is not on the circumference; hence (e) is the equation of the circle, in the same sense as (c) is the equation of the line  $EF$ .

We have thus the algebraic equivalent of a circle. This equation is of the second degree in  $x$  and  $y$ .

For example consider the following problem. Find the locus of a point  $M$  which moves so that the sum of its distances  $MF, MF'$  from two given points  $F, F'$  is constant and equal to  $2a$  ( $2a > FF'$ ). (Fig. 5.)

To solve the problem analytically take the line  $FF'$  for the  $x$  axis, and the perpendicular to  $FF'$  at its mid-point  $O$  for the  $y$  axis. If the length  $OF = c$ , then the coordinates of  $F, F'$  are  $(c, 0), (-c, 0)$ . If  $(x, y)$  are the coordinates of  $M$  in any one of its positions on its path, we have

$$\begin{aligned} MF + MF' &= \sqrt{(x - c)^2 + y^2} + \sqrt{(x + c)^2 + y^2} = 2a, \end{aligned}$$

and this is therefore the equation of the path of  $M$ .

Transposing one of the radicals, squaring and reducing, the equation becomes

$$(a^2 - c^2)x^2 + a^2y^2 = a^2(a^2 - c^2).$$

For the sake of brevity we put  $a^2 - c^2 = b^2$ ; the equation may then be written

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1.$$

From this equation we may construct the required path, point by point. The curve obtained is called the ellipse. See CONICS.

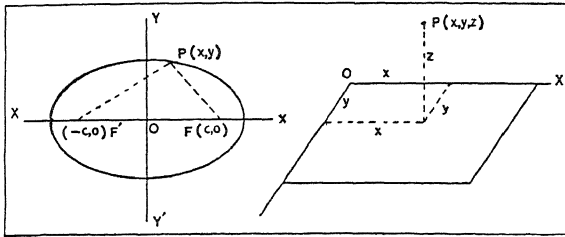


FIG. 5

FIG. 6

The method used in solving the preceding problem by the analytic method is general. It consists of four steps: (1) The statement of the geometric problem; (2) The translation of this geometric statement into algebraic equations; (3) The manipulation of these equations until they take a suitable form; (4) The translation of the algebraic result back into geometric terms.

**Coordinates of a Point in Space.** In order to locate a point  $P$  in space we may measure its distance  $z$  from a given horizontal plane, in which we have two coordinate axes (Fig. 6). If  $x, y$  are the coordinates of the foot  $M$  of the perpendicular  $PM$  from  $P$  upon the horizontal plane  $OXY$ , the three numbers  $(x, y, z)$ , the coordinates of  $P$  in space, locate  $P$ .

The number  $z$  is positive or negative according to whether  $P$  is above or below the plane  $OXY$ , and it may conveniently be measured on the perpendicular  $OZ$  erected to  $OXY$  at  $O$ . The system of reference consists now of three coordinate axes  $OX, OY, OZ$ , and also of the three planes  $OXY, OYZ, OZX$ , which planes are perpendicular in pairs. The floor and two adjacent walls in a room form a familiar model of this system of reference.

The coordinates  $x, y, z$  of a point  $P$  may be determined on the axes by the three planes through  $P$  parallel to the coordinate planes (Fig. 7).

For example, consider the case of the distance between two points in space. Given two points

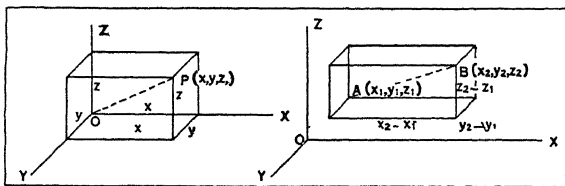


FIG. 7

FIG. 8

$A(x_1, y_1, z_1)$  and  $B(x_2, y_2, z_2)$ , if we draw through  $A$  and  $B$  planes parallel to the coordinate planes (Fig. 8) we form a rectangular parallelepiped whose edges have for their lengths  $x_2 - x_1, y_2 - y_1, z_2 - z_1$  and in which the points  $A, B$  are diagonally opposite; hence we have from Solid Geometry,

$$\overline{AB}^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2.$$

We have thus the distance formula in space.

Consider also the case of the equation of a plane. If  $P(x, y, z)$  is a point of the perpendicular bisecting plane of the segment  $AB$  we have, by the last formula,

$$(x - x_1)^2 + (y - y_1)^2 + (z - z_1)^2 = (x - x_2)^2 + (y - y_2)^2 + (z - z_2)^2.$$

This is the equation of the perpendicular bisecting plane of  $AB$ . When simplified this equation is of the form

$$Ax + By + Cz + D = 0.$$

It may be shown that the equation of any plane is of the same type.

In the case of the equation of a sphere, if  $F(a, b, c)$  is the center of a sphere of radius  $r$ , and  $M(x, y, z)$  is any point on the sphere, we have

$$(x - a)^2 + (y - b)^2 + (z - c)^2 = r^2;$$

hence this is the equation of the sphere.

This equation is of the second degree in  $x, y$ , and  $z$ . It may be shown that any equation in three variables may be interpreted geometrically as a surface.

The credit for discovering analytic geometry is usually given to RENÉ DESCARTES, who wrote the first book on the subject, although FERMAT seems to have made the discovery independently about the same time. N. A-C.

**BIBLIOGRAPHY.**—Among the great number of college texts on the subject mention may be made of the somewhat more extensive *Plane and Solid Analytic Geometry*, by W. F. Osgood and W. C. Graustein, and the *Introduction to Higher Geometry*, by W. C. Graustein, 1930.

**ANANIAS**, high priest of the Jews (c. 47-59 A.D.) under Herod Agrippa II. The Acts of the Apostles (23:2, 24:1) says that St. Paul was accused before him. Although he lived in the degenerate days of the priesthood, Josephus writes (*Antiquities* 20:9, 2) that he "increased in glory every day," after his retirement. The Talmud (*Pesahim*) speaks of him in terms of contempt. Accused of violence, he was sent to Rome but acquitted by the Emperor Claudius, but was murdered by his own people at the beginning of the Jewish revolt.

**ANARCHISM**, a movement organized on the belief that society should be run entirely by voluntary, organized groups and not by the political state. All social coercion is to be dispensed with, so that the fullest development of each individual may be attained. Underlying this theory, frequently, is the ancient belief that prior to civilization, there existed a golden age of freedom which may be reconstructed through the abolition of the state, the church, private property and the wage system. Government is held to be the supreme tyrant sustaining other initiative-crushing institutions; hence all laws, precepts and restraints must be abolished. Decentralized, voluntary groups are to be substituted, organized, as most anarchists feel, on a syndicalist basis (*see* SYNDICALISM). Under this plan, goods would be exchanged without money profit by cooperative industrial groups, the participants sharing equally in the product. No compulsion to work is to exist, reliance being placed upon the pleasure derived from it.

Since complete individual development is sought, stress is laid on a nonsectarian education for all and equal rights, regardless of sex and age. Freed from a hampering social environment, the individual would develop, restrained only by his ethical conceptions.

Anarchists differ as to methods of attaining their ends. The leading figures have faith in non-violent measures. A small minority has, however, brought condemnation on the movement by terrorist actions. Prince Kropotkin has noted four schools: Proudhonian mutualism, based on the mutual exchange of all commodities under a labor hour plan; communist anarchism, which stresses mutual exchange and the abolition of all private property as well; Christian anarchism, which maintains that Christ's teaching proves that the state and all of its dependent institutions should be abolished and brotherly love prevail; and literary anarchism, the intellectual support to which has been furnished by writers and poets such as RABELAIS, DIDEROT, NIETZSCHE, THOREAU, EMERSON, WALT WHITMAN and IBSEN. To this list might be added the cooperative anarchists who hold that the voluntary mechanism of the consumers' cooperative movement should be expanded to the end that the state be abolished. J. P. Warbasse is outstanding among those holding this opinion.

Anarchist philosophy can readily be traced back to Zeno's answer to Plato's *Republic* in the 4th century, B.C. In the 2nd century B.C. and again in the Middle Ages groups attempted to live by these doctrines. The Brothers and Sisters of the True Spirit, a religious sect, formed in the latter period, was subjected to persecution but left a following in Germany, France, Belgium and Switzerland. Stirner introduced the element of terrorism to attain reforms. To PROUDHON credit might be given for making anarchism a mass movement. Though some authorities hold that he gave it its name, more recent research tends to the opinion that the term was in use in the Middle Ages and certainly at the time of the French Revolution. American radical thought has been substantially influenced by anarchism. Josiah Warren launched an Equity Store in Cincinnati in 1827, for the exchange of goods according to their labor time in production. His Equity Village in New York survived for more than 40 years. Noteworthy also are the writings of Lysander Spooner, William Green, Stephen Andrews and Benjamin Tucker.

The Haymarket riots and the murder of President WILLIAM MCKINLEY by an anarchist (1901) brought laws prohibiting the entrance of anarchists to the United States. Some states have legislation barring the employment of anarchists or making the advocacy of anarchist doctrines unlawful if violence is urged.

C. E. W.

**BIBLIOGRAPHY.**—P. Kropotkin, *Conquest of Bread*; Benjamin Tucker, *Individual Liberty*, Bernard Shaw, *Impossibilities of Anarchism*.

**ANASITCH**, the name of an American Indian tribe of the Kusan linguistic stock. Its members lived south of Coos Bay on the Oregon Coast.

**ANASTASIUS**, the name of four popes and of several saints. St. Anastasius, the martyr, was a converted Persian soldier in the army of Chosroes II. Rebuking his fellow countrymen at Caesarea for their magic and fire worship, he was offered a choice between torture as a Christian and the highest honors if he would renounce his faith. In 628 he and 70 others were strangled and beheaded, their bodies being thrown to the dogs, which, however, refused to touch the remains of Anastasius. His relics, after preservation at Constantinople, were brought to Rome.

**ANASTIGMATS.** See PHOTOGRAPHIC OBJECTIVE.

**ANATASE**, also called octahedrite, a brown, blue or black mineral with a brilliant luster. It varies from opaque to transparent, the brown transparent varieties being used for gems. Like RUTILE, anatase is titanium dioxide, and crystallizes in the TETRAGONAL SYSTEM, but the cleavages of the two differ. Anatase is usually found in mica SLATES, SCHISTS, GNEISSES and metamorphosed limestones. Good, transparent crystals come from North Carolina and are also found in England, France, Germany, Switzerland and Brazil. See also METAMORPHIC ROCKS; GEM STONES; PETROLOGY.

**ANATHEMA**, an ecclesiastical term, meaning an absolute condemnation. To the Greek, anathema signified the suspension on high of something, such as an offering to a god. In Luke 21:5, the gifts adorning the Temple at Jerusalem are called *anathemata*. Hence, the word suggests a severance or cutting off, and is so used by St. Paul (Galatians 1:9, Romans 9:3). In the Catholic Church there are three grades of EXCOMMUNICATION, described as minor, major and anathema. When the Pope reads an anathema he is attended by 12 priests carrying candles, and when the formula is uttered the candles are dashed to the ground while the people reply, "*Fiat, fiat, fiat,*" Let it be done. Although rarely put into execution in modern times, the anathema is always mitigated by a clause inviting to repentance.

**ANATOLIA**, a name applied to the peninsula embracing the western extremity of Asia, that is, ASIA MINOR. The name is often loosely used, but it should refer specifically to the region bounded on the south by the eastern Mediterranean, on the north by the Black Sea, the Sea of Marmora and the Dardanelles, on the west by the Aegean and on the east by the Euphrates River. All of this territory is under Turkish rule and comprise about two-thirds of that country's Asiatic area. See TURKEY.

**ANATOMY** is that part of Biology which deals with form and physical qualities (morphology) as distinguished from the part which deals with function (physiology). It is the science of structure and gathers its facts from the living and dead bodies of animals, including the human, and from plants. It deals not only with the form and physical qualities apparent on the surface of these bodies, but also with those of all the inner parts as revealed by dissection, microscopic examination, X-ray and other methods. It seeks to know the elements (cells, etc.) of which

the parts are made and the method of their combination. It studies their size, extent, position, connections, color, substance, and texture.

But a living organism is not a static structure: it is dynamic; it changes; a live animal is a thing which is happening. The human body runs through a series of changes 70 years long between birth and death—and millions of years long before birth, for bodies like lives are just continuations of ancestors from the most remote ones. Anatomy follows these changes as they appear in evolution, in growth and work, in reproduction, and in age and death. The science is responsible not only for all the facts gathered from all this vast field, but also for the attempts that have been made to set the facts in order and to understand them. The task of Anatomy is to discover the principles of structure and form as they appear in organisms, the cause and origin of forms and of their continuity or transformation, and to devise and apply methods for performing these tasks.

**Divisions of Anatomy.** A science with so many objectives and covering so vast a field will necessarily have many subdivisions. Of these the two essentially different ones are (A) *Descriptive Anatomy* and (B) *Comparative Anatomy*. The former studies individuals: the latter studies laws or uniformities of structure and form as they run through large groups of different organisms. The former makes additions mainly to knowledge, the latter to understanding. Comparative Anatomy seeks explanations. Subdivisions of the science based upon *restriction to part of its field* are Anatomy of Plants, Anatomy of Animals or veterinary anatomy, Human Anatomy, Histology or anatomy of tissues (muscle tissue, bony tissue, etc.), Cytology or anatomy of cells: Neurology or anatomy of the nervous system, Embryology or anatomy of embryos. The list might be considerably extended. Among the subdivisions based upon *methods employed* are Gross Anatomy, Microscopic Anatomy and Roentgenology or X-ray anatomy. These subdivisions are of more than abstract interest for they indicate different lines along which investigation is prosecuted by different people. They represent fields covered by textbooks; different courses offered in schools, and different departments or divisions in universities throughout the world. The term *Physiologic Anatomy*, and the books, professorships, etc., occasionally found in that field represent not so much a subdivision of Anatomy as an attempt to throw on the problems of Anatomy the added light derived from study of function. Our abstract thinking tends toward logical classification with sharply drawn dividing lines, but in practical work and in seeking to understand the nature of any particular organism the contributions of all the sciences tend to be brought together and dividing lines disappear. Progressive change in structure goes so often hand in hand with function that the search for causes requires the constant aid of Physiology.

The science touches many human interests. Agriculture (crop raising) is especially interested in the

anatomy of plants, stock raising in veterinary anatomy, many industries (e.g., silk and wool), in animal anatomy, medicine in human anatomy. Painting, sculpture, physiology, education, anthropology, ethnology, and sociology have all joined with medicine in stimulating the study of human anatomy, with the result that it is by far the most thoroughly cultivated part of the whole field of the science.

**Laboratories.** Human Anatomy has been studied in the past mainly in medical schools. But now the general science is represented in many universities by departments which receive students from any part of the institution. There are also a number of institutes for anatomical research like the Wistar Institute at Philadelphia, the Senkenberger Institute at Frankfurt and the Carnegie Institute for Embryology at Baltimore.

The work of most anatomical laboratories is carried on in five main divisions: (1) Dissection of human (and other) bodies; (2) Histology—usually including Cytology, with tissue culture as an important subdivision; (3) Neurology; (4) Embryology; (5) Roentgenology or Radiology (X-ray work).

**Methods.** The methods employed are dissection which has given its name to the whole science, injection, maceration, corrosion, X-ray photography and direct observation of X-ray shadows (fluoroscopy). For microscopic study, small pieces in appropriate fluids are put upon the microscopic stage and teased apart with needles or systematically dissected with microdissection apparatus, or the material is infiltrated with and imbedded in some medium (paraffin, celloidin, etc.) and thin sections are cut, stained differentially and mounted on glass slides for study. The whole organism may be thus cut in serial sections. Models in wax of such sections (or parts of them), enlarged as much as desired are superimposed in order and reconstructions made of any organ: this method has been very useful in the study of embryos. Explanted bits of living tissue are placed in appropriate fluids in warm chambers and studied by observation and experiment sometimes for over fifteen years. Micro-photographic moving picture cameras are used to take at any desired intervals successive pictures recording progressive changes during activity or growth.

**Units of Structure of Animal Bodies.** As a result of anatomic work along these various lines, it has been found that animal bodies are made up of various "systems" (nervous system, vascular system, digestive system, etc.). These are differentiated both in structure and function. They are in turn composed of individual "organs," e.g., the brain is part of the nervous system, the stomach of the digestive system, and so on. Each organ is made up of various "tissues," as connective tissue, muscular, nervous, osseous, epithelial tissues, etc., the study of which (histology) is of general significance and was formerly called "general anatomy." The tissues were found in 1839 to contain cells, and by 1860 the fact was recognized that tissues are made up entirely of

animal cells or their products. The cells are, therefore, units of structure, but not necessarily the final units.

**Cells.** Living substance tends to clump in small masses about  $\frac{1}{1000}$  inch in diameter, perhaps so as to have surface enough to absorb food and excrete waste. These clumps are cells: in plants they build strong walls—in animals only membranous ones, flexible and permeable.

The substance (*protoplasm*) is viscid, semifluid, gluey. It is contractile and irritable; it responds to stimulus, usually by movement. It is composed chemically of carbon, hydrogen, nitrogen, oxygen and sulphur. Sometimes other chemical elements are mixed in (phosphorus, calcium and chlorine). It is a colloid—a very plastic form of chemical combination. It breaks down readily—liberating energy usually expressed in contraction and so in motion. But it builds up its substance again—in excess. It grows. It divides into two, each of the new cells being like the original one. They are the original one—not just the children of it.

The cell is not uniform throughout. In the center is a *nucleus*, surrounded, except during cell division, by a nuclear membrane. Within it is a network of still denser, easily staining substance (*chromatin*). One or two *nucleoli* are within the nucleus; they are small globules of special substance. Outside the nucleus is the protoplasm of the cell (*cytoplasm*). It is made up apparently of fluid globules with a semifluid membrane round each. Near the nucleus is the attraction sphere—a small deeply staining body called the *centrosome* seems to radiate some influence through a clear area of protoplasm round it. Fine rods called *mitochondria* are embedded in the cytoplasm. Many cells contain globules of fat-like substance, *vacuoles*, full of clear fluid and absorbed food material.

The nucleus is necessary for the life of the cell and appears to have a directing influence over it. Little is known, however, of the function of all these parts, but they have marvelous capacities. It is certain that within one such cell, the *germ cell*, are contained all the body qualities that can be inherited—the color of the eyes—the character of the mind. Such a cell is very complex. Beyond what can be seen with the most powerful microscope there is room in it for an infinity of structure. In some way the combination of these molecules causes life, and gives its character to each organism. The adult human body contains about 27 million million cells, each with an individual life but associated into a vast community organization.

**General Plan of Structure of Vertebrate Bodies.** The general plan of the structure of vertebrate bodies appears more clearly in the embryo than in the adult. The existence of a common general plan is indicated by the similarity in early vertebrate embryos. The essential structures are: (a) a membrane enclosing the entire body, called the *ectoderm* or outer skin; (b) a tube, the *spinal cord*, running lengthwise in the back, or dorsal, part of the body;

(c) a rod, the *notochord*, running lengthwise along the central axis of the body; (d) a tube made of ectoderm, the intestine or *alimentary canal*, paralleling the notochord in the ventral (anterior) part of the body; (e) the intermediate mass, the *mesoderm*; and (f) the intermediate fluid, the *mesenchyme*.

In the median plane of the body there are thus three structures running lengthwise—a rod, the notochord, along the central axis; one tube, the spinal cord, dorsal to it, and another tube, the alimentary canal, ventral to it. On each side of the median plane lies the intermediate mass, or *mesoderm*. This forms a considerable pad of tissue on each side, extending from the dorsal to the ventral part of the body. It is hollow, for a cleft-like cavity appears between its outer and inner layers. The cleft-like spaces are called the right body cavity and left body cavity respectively. They are entirely separate, except in the lower part of the abdomen, where they become continuous in front of the intestine, thus making only a single body cavity in the abdomen (the peritoneal cavity). These four structures that lie within the embryonic skin do not take up all the room. They are separated from one another and from the ectoderm by chinks and clefts and irregular spaces of considerable size. These are not empty, but are filled with mesenchyme or intermediate fluid. This is not pure fluid, for it contains branched cells connected together by their branches to form a loose, spongy, fluid tissue that extends into all nooks and crannies and into all the intercellular spaces in the definitely formed structures. These are the six fundamental parts of which the body is made.

(a) The *ectoderm*, or embryonic skin, forms the epidermis or superficial layer of the adult skin. Along the middle of the back of the head and trunk it is thickened and folded in to form first a trough and then a tube; thus the neural tube is formed from the embryonic skin.

(b) The *neural tube*, or *spinal cord*, or central nervous system extends the whole length of the body. It has, in the adult, thick walls and a small central canal. It is much bigger at the head end, where it constitutes the brain, than in the trunk, where it constitutes the spinal cord. The young spinal cord has a beaded outline, with thirty-one segments. A pair of nerves grows out from each segment—one right nerve and one left one. Each spinal nerve has two roots, one dorsal and one ventral. The dorsal root brings in information, and the ventral one carries out to muscles stimuli that provoke the action desired.

(c) The *notochord* terminates headward in a blunt end under the middle of the brain; tailward it extends to the tip of the vertebral column. It is a flexible rod. In the most primitive fishes, which have no bone, it is useful in their swimming movements. In higher vertebrate animals, including man, it is of little use in the adult. It runs through the centers of the bodies of the vertebrae, like the cord through a string of beads, and remnants of it appear in the them and contribute to their springiness. In the em-

bryo it gives a certain amount of rigidity to the body and later serves as a central rod around which the column of vertebral bodies grows.

The mesenchyme, which fills all spaces between the parts, forms the connective tissues, the blood, the arteries, veins and lymph vessels, and the heart. Thus it binds the parts together, surrounds the cells with fluid, carries nourishment to living cells and removes the waste produced by their activity. Many of its cells remain free and swim about independently; they are scavenger cells and they remove the remains of dead cells and foreign matter such as dirt and bacteria which may gain entrance.

(d) The *alimentary canal* extends headward under the notochord as far as the mouth cavity. The head end of it is enlarged to form the pharynx. It extends backward to the anus, almost but not quite at the tip of the vertebral column. The alimentary canal runs straight through the neck and thorax, forming the gullet. The part that is within the abdomen is dilated at its upper end to form the stomach. The rest forms the intestine, or gut. This becomes greatly elongated, attaining a total length of nearly 30 feet. It is, therefore, much folded. But it preserves the relations with the other organs, remaining always in the partition between the two mesodermal sacs, even though the partition also becomes folded. (See ALIMENTARY CANAL.)

Several outgrowths from the intestine appear in the neck and abdomen. In the neck these are the thyroid gland, the parathyroid glands, the thymus and the breathing apparatus. The thyroid gland and the two parathyroids remain in the neck, lying close to the pharynx. The thymus gland grows downward. The breathing apparatus grows off the gullet high up in the neck as the larynx, extends down in front to the middle of the thorax as the trachea and there grows out to each side as the huge lungs, which fill the thoracic part of both the right and left body cavities of the embryo. In the abdomen two outgrowths extend from the gut, the liver anteriorly, and the pancreas posteriorly. Two buds fuse to form the latter.

The lowest part of the embryonic intestine splits into two parts lengthwise for a short distance. The anterior one of the two tubes so formed becomes the urinary bladder and urethra, which are thus only a part of the intestine separated off from the rest.

The alimentary tube differs fundamentally from the neural tube in one important particular: it never shows any trace of segmentation.

(e) The *mesoderm* becomes subdivided into dorsal and ventral parts. Very early a long horizontal constriction appears in it just ventral to the notochord. This separates it into a ventral part associated with the alimentary tube and a dorsal part associated with the neural tube. The ventral part is split into two layers inclosing the body cavity. The inner layer becomes closely connected with the alimentary tube, forming its outer coat of muscle and its peritoneal coat. In the neck both right and left cavities close

up; their two walls fuse and so there is only one membrane formed by the ventral mesoderm. The outer layer of the ventral part of the mesoderm becomes a simple membrane—the parietal pleura in the thorax, the parietal peritoneum in the abdomen. This membrane at first is close to the ectoderm, or epidermis, but later becomes separated from it by the body wall, as it grows from behind forward.

The dorsal part of the mesoderm forms the body wall, comprising the deep layer of the skin, the vertebral column, the ribs, and the muscles with their fascial envelopes. It is associated with the neural tube. Like that tube, it becomes divided into segments called “somites.” The dorsal mesoderm thus looks like two rows of hollow bricks, one on each side of the spinal cord. There are thirty-one segments of the spinal cord, with thirty-one pairs of nerves growing off from it, and there are thirty-one of these somites on each side. Into each of these brick-like somites grows one of the nerves. From these hollow bricks the body wall is formed. Each hollow brick grows forward extending around the body cavity of the embryo and the gut; each grows a bandlike process backward around the neural tube; each grows a process medialward to the notochord, which becomes the body of a vertebra. Thus the body wall is segmented. It is formed in a series of strips, like a gridiron; this is apparent in the adult in the ribs and the intercostal muscles. It is less apparent but equally true in the abdomen. And each segment has its own nerve.

(f) Between the muscle layer and the dermis is an interval which the mesenchyme fills. This is the superficial fascia. The limbs are formed in it entirely; the bones of the limbs and limb girdles are simply modified superficial fascia. The skin is stretched over the growing limbs, and nerves and arteries grow into them. But they are essentially superficial, lying outside the body wall.

The body wall ceases at the top of the neck. In the head, the upper ends of the neural tube and of the alimentary tube project over the wall to come into direct relation with the world outside. They have to—the neural tube to get information and the alimentary tube to get food and oxygen. So the brain develops the “distance” sense organs—eyes, ears, nose, and the head part of the gut (face) develops jaws, and breathing apparatus (gills and lungs). All vertebrate embryos have gills. Few vertebrate animals have hands to help the head gut get food: in most the head gut manages it alone.

The nervous tube is the master organ: all other structures are but servants in its house to feed it and move it about toward food or pleasure and away from danger.

**History.** Many anatomical facts were discovered before the Christian era, but they were so disconnected and so imperfectly understood that there was practically no science. Galen, a Greek living in Rome (d. 200 A.D.) put all that was then known into systematic form. He had studied lower animals but not



the human body about which he wrote. His writings were so good systematically, so bad scientifically, and so satisfying scholastically they held the development of Human Anatomy thoroughly in check for 1300 years. Vesalius, a Belgian living in Padua (d. 1564), resuscitated the science. At the instigation of his own genius, and with the encouragement of artists, lawyers who usually wanted to find the cause of death often dubious—and of Emperor Charles V, he thoroughly dissected human bodies and with the artists' help made accurate and beautiful drawings. The doctors did not help: they were too thoroughly committed to Galen. His book *On the Fabric of the Human Body*, published at Basel in 1543, was the first real textbook of Human Anatomy. It was not only the foundation of modern Medicine as a Science, but "the first great positive achievement of Science itself in modern times." William Harvey of London published in 1628 his book *On the Motion of the Heart and Blood in Animals*. His discovery of the circulation did more than the work of any other man to advance the sciences of Anatomy and Physiology. Marcello Malpighi of Bologna, Italy, demonstrated in 1661 the blood capillaries connecting the arteries and veins, which Harvey foresaw and which he would have loved so much actually to see. M. F. X. Bichat, Paris (d. 1802), was the founder of "General Anatomy" or Histology. Baron Cuvier of Paris (d. 1832) established Comparative Anatomy as an indispensable aid in the understanding of anatomic phenomena. Karl Ernst von Baer of Königsberg laid about 1837 the foundations of Embryology. Theodore Schwann, Louvain, laid, about 1839, the foundation of the Cell Theory. Charles R. Darwin published in 1859 his book on *The Origin of Species by Means of Natural Selection*, offering a fundamental explanation of the changes in animal forms. Wilhelm His of Leipzig (d. 1906) and Camillo Golgi of Pavia (d. 1926) were leaders among those who founded in the latter part of the nineteenth century the Modern School of Neurology. W. C. von Roentgen of Würzburg reported in 1896 his discovery of the X-rays, which are the basis of Roentgenology.

The numerous journals devoted to the publication of anatomical papers are an indication of the wide interest and activity in the science throughout the world.

B. C. H. H.

**ANATOMY, PLASTIC.** Anatomy in art is called Plastic Anatomy, and it embraces the examination of the bones, joints, muscles and position of the organs of the body which determine the external form of the human body. Its purpose is to assist the artist to portray the attitudes, movements and emotions of the human figure.

M. Duval in his lectures on Plastic Anatomy, delivered at the École des Beaux-Arts, divides the subject into 1. Osteology and Arthrology, the study of the skeleton and joints; and 2. Myology, the study of the muscles.

In studying the bone structure it is necessary to examine the skeleton of the trunk, the shoulder, the

humerus or arm-bone, and elbow-joint, the forearm, the hand, wrist and fingers, the hips, the femur or thigh-bone, together with the articulations of the hips, comparing the proportions of the hips and shoulders, the articulation of the knee-joint and shape of the region of the knee, the bones of the leg and foot and the proportions of the lower limbs, and the skeleton of the head and face.

In determining the proportions of the human body various methods have been used. According to an ancient Egyptian canon, the height of a man was said to be nineteen times the length of the middle finger. Another ancient measurement gave the hand as a unit, the height of the body being ten times the length of the hand. Duval says that LEONARDO DA VINCI and ALBERT DÜRER followed the rule which took the head as a unit, the height of the head being one-eighth of the whole body. In his writings Leonardo mentions the face as a unit of measurement: "from the chin to the highest point where the hair begins is one tenth of the whole structure." The formula known as the "square figure of the ancients" gives the span of the upper limbs as the same measure as the height of the man. Duval says this is true of Caucasians, but not of the yellow and black races whose arms are longer, making the horizontal span greater than the height of the body. A modern authority believes the body and its parts can best be measured by the ratio of mean and extreme proportion; "of two quantities the lesser must be to the greater as the greater is to their sum." The distance between the wrist and elbow, the elbow and the collar bone are said to be in extreme and mean proportion and that this ratio holds true as between the foot, knee and hip. The width of the leg at the calf with the ankle, the forearm with the wrist and the thumb with the middle finger are in extreme and mean proportion, as is also the height of the body as divided vertically at the navel.

The important muscles studied in Plastic Anatomy are those of the trunk, the back, the shoulder, the arm, the forearm and hand, the pelvis, the leg, the foot, the neck, and those for the head and various sections of the face which determine and control, for example, the expressions of grief, mirth and repose. The knowledge of the muscle structure is especially important since the form of the body is determined by the muscles and this form constantly changes as the muscles are contracted or relaxed by the action of the nervous system.

Anatomical drawings made by Leonardo, MICHELANGELO and RAPHAEL are evidence of the importance these masters placed upon the study of anatomy. Leonardo first noted and portrayed the action of the platysma muscle of the neck in the expression of violent passion. Camper analyzed the action of the facial muscle and showed that "the contraction of each muscle of the face produced in the skin one or more folds of which the direction is always at right angles to that of the muscle." Humbert de Superville, Duchenne and CHARLES DARWIN made valuable con-

tributions to the knowledge of the way in which muscular action invariably expresses certain emotions.

**BIBLIOGRAPHY.**—A. Melville Paterson, ed., *Duval's Artistic Anatomy*, 1914; Colman and Coan, *Proportional Form*, 1920.

**ANAXAGORAS** (c. 500-c. 428 B.C.), Greek philosopher, was born at Clazomenae around 500 B.C. He migrated to Athens about 460 B.C., where he spent some 30 years. Here he had a number of followers; but his contempt for the official religion caused him to be banished to Lampsacus. Anaxagoras believed in an infinite number of elements that are uncreated and indestructible. They are, however, inert until moved by mind (*nous*). It is the *nous*, a creative principle outside of the elements themselves, for which he is noted. Anaxagoras died about 428 B.C.

**ANAXIMANDER** (c. 611-c. 547), Greek mathematician and philosopher, was born at Miletus, Asia Minor. He taught that the origin of man was from some other animal, preferably aquatic, and that the cosmos was made up of a group of concentric cylinders,—the sun, moon, stars, earth,—equidistant from each other, and thus held in place. This universe had evolved by the separation of opposites such as hot and cold, or dry and moist from an indestructible, limitless, everlasting chaos, and returned to this after destruction.

**ANAXIMENES** (c. 380-320 B.C.), Greek rhetorician and historian, was born at Lampsacus, Asia Minor, in the 4th century B.C. He is said to have taught rhetoric to Alexander the Great. He was the author of histories of Philip of Macedon, Alexander and of Greece. Anaximenes is now credited with the *Rhetoric* formerly attributed to Aristotle.

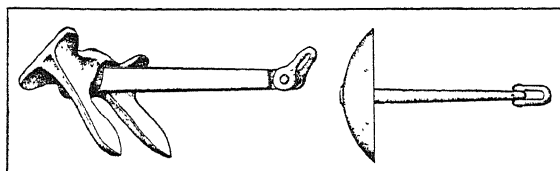
**ANCESTOR WORSHIP**, the term applied to the religious cult of deceased forefathers. This cult is practised to-day by perhaps about one half of the human race. It has its origin in the primitive belief that a human being continues to live after death, the soul being only temporarily absent, and consequently that the body requires food and drink as in normal life. This belief naturally led to the conclusion that neglect of the dead rendered them evil in intention and action toward those responsible, while the reverse treatment secured for the descendants of the dead person his help and beneficent intervention. Ancestor worship is thus inspired as much by fear and self-interest as by natural family affection. The cult is exceedingly widespread from the geographical as well as from the numerical point of view. It flourished among the ancient Romans, and it exists to-day in Africa, Siberia, India, Polynesia and notably in China, where it has remained the dominant religion. The wide prevalence of the cult has led some scholars to believe that it is the basis of all religions.

**ANCHIETA, JOSÉ DE** (1534-97), Spanish Jesuit scholar, was born in Tenerife in the Canary Islands. In 1542 he went to Coimbra to study and in 1550 became a Jesuit, coming to Bahia three years later. He founded the College of Piratininga in São Vicente and became its rector in 1569. In 1578 he went to Bahia as head of the Jesuit Province, and 10

years later to Rio de Janeiro and then to Espirito Santo, where he founded a number of Indian villages. Anchieta was one of the most distinguished Jesuits in Brazil, noted not only for his pioneer work in education and his endeavors to civilize the Indians but also for his literary talents. He was a great poet and orator and won renown as a linguist, writing in Spanish, Portuguese, Latin and Tupí.

**ANCHISES**, a prince of Troy whose beauty attracted the admiration of Aphrodite, who became the mother of AENEAS. Fearing the wrath of Zeus, the goddess warned Anchises to be silent over the romance, but inadvertently he boasted of the matter and was struck by lightning. A later story, told by Virgil, is that after the fall of Troy Aeneas escaped from the city with Anchises on his shoulders, and that the old man died and was buried in Sicily.

**ANCHOR**, an iron or steel device, that is embedded in the ground for securing a vessel. It sometimes consists of a shaft or shank at one end of which are palms or flukes, while near the other end is a stock or transverse piece of iron, and at the end is a shackle or ring to which the anchor CHAIN or cable



ANCHORS  
Stockless and mushroom types

is attached. For convenience in stowing in the hawse pipe of a ship, the stock is now usually omitted, hence the term "stockless anchor." Mushroom anchors have a central shank with a saucer shaped head, and are adapted for permanent moorings. Sea anchors conical or pyramidal shaped canvas bags with a small hole at the end, are built of canvas and wood. They are used in heavy weather to keep a vessel headed into the sea.

**ANCHORAGE**, a port and incorporated town in the third judicial division of Alaska, in the southern part of the territory, situated at the mouth of Matanuska River, on Turnagain Bay, at the northern end of Cook's Inlet. It is served by steamships and the Alaska Railroad and has an airport. There are commercial fisheries and salmon canneries. Much of the surrounding region is forested. Gold and coal are found in the immediate district. Anchorage lies between the Alaskan range on the west, and the Chugach and the Kenai mountains on the northeast and southeast. Pop. 1920, 1,856; 1930, 2,277.

**ANCHOR ICE**, water frozen in granular masses, lying near or on the bottom of streams, lakes or shallow seas. This anchor ice, or "ground ice," rising when detached by the sun's heat, often obstructs canals, penstocks, or the intake of waterworks. Ship's anchors are sometimes brought up embedded by the ice, and huge boulders are floated and carried far downstream. Rapid radiation on clear cold nights

may explain the formation of anchor ice in rivers. Some scientists think that underground springs in sea-bottoms explain its presence in salt water.

**ANCHOVY**, a small, carnivorous fish of the HERRING family, with an elongated body, pointed snout and large, deeply-cleft mouth. The maximum length of the anchovy is 8½ in., but many species are much smaller. The European anchovy (*Engraulis encrasicolus*) is abundant in the Mediterranean and along the Atlantic coast to southern Norway, and similar species are found in California, Chile, Japan and Australia. This genus has numerous vertebrae, the bones are soft and the flesh tender and oily. It swims in large schools and is caught in seines, to which it is attracted by bright lights in the fishing boats. Since ancient times the anchovy has been preserved in oil or made into fish paste, valued as a relish. The genus (*Anchovia*) which is found in the tropics, is not much good for food. The silver anchovy (*Anchovia browni*) abounds in sandy bays from Cape Cod to Brazil.

**ANCIEN RÉGIME.** By the term *ancien régime* is understood the political, social and, to a certain extent, economic system of France before the Revolution of 1789. The division of the nation into three orders, clergy, nobility and commoners or third-estate; the privileges, social and financial, of the first two orders to the exclusion of the third-estate; the haphazard and overlapping divisions of France for purposes of government—*généralités*, provinces, *senéchaussées*, bailiwicks, etc.; the possession by the Church of about one-fifth of the land; the practice of farming out taxes; the 200 different law codes or customs in force in various parts of France; the unequal distribution of burdens and duties typified by the *taille* or land-tax, the *gabelle* or salt-monopoly, the *vingtième* or income tax, the *corvée* or road-building duty and numerous other obsolescent feudal dues—all these features of the highly centralized monarchical government of 18th-century France are comprised in and implied by the term *ancien régime*. The phrase is also the title of a famous book on the subject by the French historian, Hippolyte Taine. J. BA.

**BIBLIOGRAPHY.**—E. J. Lowell, *The Eve of the French Revolution*; Hippolyte Taine, *The Ancient Regime*; A. De Tocqueville, *The Ancient Regime*.

**ANCIENT MARINER, THE RIME OF THE,** a mystical poem by S. T. COLERIDGE; published 1798. This, one of the most remarkable poems in English, is the dramatic history told to a stranger by the Ancient Mariner, of the evils which descended upon a ship and its crew as the result of the slaying of an albatross, a bird regarded as sacred by sailors. The almost spectral Mariner, grown old and penitent virtually overnight, tells his story of bewitchment and supernatural evils with an intensity of expression that perfectly fits his subject and which leaves an impression in the mind of his audience of strange remorse and visionary beauty. It is a poem told with a brevity and conciseness which never fail. The imagery, simple yet at all times adequate, touches one scene after an-

other on the terror-stricken ship with the full genius of the author whose "one great complete work" this poem may be said to be.

**ANCIENT WEIGHTS AND MEASURES.** See WEIGHTS AND MEASURES, ANCIENT.

**ANCONA**, a seaport of central eastern Italy, capital of the province of the same name, picturesquely situated on the foothills of Mt. Conero, sloping down to the Adriatic. The old part of the city on the water front has steep and narrow streets adorned with numerous public buildings. Apart from valuable Roman remains, Ancona has a cathedral, the 13th century Church of S. Maria della Pizza, S. Maria Maggiore with rich Gothic portal, and other churches of interest, handsome palaces, and museums with rich treasures. As a seaport, it is the seventh in Italy and does much shipping to Istria, Fiume and Zara and also to the Levant. The leading industries are fishing, shipbuilding and sugar manufacture. The ancient *Ancona Dorica*, in medieval times the city carried on an unceasing warfare against emperors and popes, against Byzantium, Venice, Naples. Ancona was besieged in vain by Frederick Barbarossa and was under German control in the 12th century. After 1532 it was a part of the Papal States; French, Austrian and Russian troops occupied it at various times in the 19th century and it surrendered to the Italians in 1860. During the World War it was bombarded by the Austro-Hungarian fleet. Pop. 1931, 83,288.

**ANDALUSIA**, the most southern part of Spain, embracing the four former Moorish kingdoms and now divided into eight provinces.

On the south slope of the Sierra Nevada pure-blooded descendants of the Moors still live, and many thousands of gypsies are scattered throughout the region. In the earliest times Andalusia was inhabited by a gentle, peaceful people who could not withstand their foes. The Phoenicians first settled there in order to exploit the rich silver mines. Later the Carthaginians occupied the territory. In 206 B.C. it became a Roman possession and was the center of Roman life and culture in Spain. Poets, sages and emperors, such as Lucan, Seneca and Trajan, came from Cordoba and Seville. In the first part of the 5th century the country was overrun by the Vandals. They were followed by the West Goths, who pushed the Vandals across to Africa, and in the 6th century ruled all of Spain. But in 711 they were conquered by the Arabs, who founded a new dynasty of caliphs, choosing Cordoba as their capital. The arts and sciences flourished, but when the dynasty became extinct, the caliphate broke up into independent Moorish states, which were finally conquered by Ferdinand II in 1233-50. Since that time Andalusia has been part of Castile and has shared in its destiny.

Fruits and cereals are grown in large quantities in the rich sections of Andalusia. Wine making is a flourishing industry, and cattle raising is important. Est. pop. 1929, 4,200,000.

**ANDALUSIA**, a city in southern Alabama, the county seat of Covington Co., situated near the

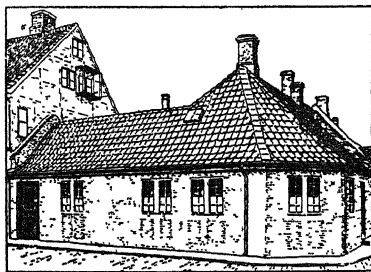
Conecuh River, about 92 mi. south of Montgomery, served by two railroads. Andalusia is an industrial and trade center, with garment factories, hulling mills and other plants. Located here is the main office of a large hydroelectric power company. Cotton, grain, peanuts, tobacco, dairy products and poultry are the agricultural interests. Pop. 1920, 4,023; 1930, 5,154.

**ANDALUSITE**, a mineral common in some SCHISTS, which is used as a semi-precious stone when occurring in fine, transparent specimens. The color may be green, gray, pink, red, violet or brown. The brown and green cut stones resemble tourmaline. Andalusite is an aluminum silicate crystallizing in the ORTHORHOMBIC SYSTEM. It is found in Andalusia, Spain, whence it derives its name, and also in Ceylon and Brazil. See also GEM STONES; PETROLOGY; SILIMANITE.

**ANDAMAN ISLANDS**, an archipelago in the Bay of Bengal, composed of five large islands called the Great Andaman group, an island to the south called Little Andaman and some 200 islets. The total area of the group is 2,508 sq. mi. The surface of most of these islands is covered with luxuriant forests. The two principal ones are Great Andaman and Little Andaman, which are separated by Duncan passage. All the others are mere islets. Rubber, hemp and coconuts are cultivated and cattle and goats are reared. The islands are owned by Great Britain and are administered by the Government of India. Since 1858 the Government of India has had a penal settlement on these islands and in 1931 of the total population of 19,223 one-half consisted of convicts.

**ANDANTE**, an Italian term in musical EXPRESSION used to indicate a moderate tempo, midway between ADAGIO and ALLEGRO. Although it connotes a marching tempo, andante bespeaks a flowing, distinct style. It is often modified, as "andante sostenuto," a little slower, or "andante con moto," meaning a little faster, than the tempo indicated when the word stands alone. Andante is also used as the name of an instrumental composition, as Beethoven's *Andante in F*; in a symphony the andante is frequently the second or third movement.

**ANDERSEN, HANS CHRISTIAN** (1805-75), Danish writer, was born at Odense, Denmark, Apr. 2,



BIRTHPLACE OF HANS CHRISTIAN ANDERSEN, IN ODENSE, DENMARK

1805. His father, who made a bare living as a cobbler, was well-educated and had a great influence on his son's early life, and the development of his imagi-

nation; he died when Hans was 11. At 15 the boy went to Copenhagen to find work in a theater, but his gawky appearance and awkward dancing closed the doors to him. Undaunted, he tried writing plays. This effort showed so much promise that arrangements were made for him to enter the government school at Slagelse, and later the University of Copenhagen where he continued to show more energy in writing than in studying. In 1833 a royal grant enabled him to travel, and in Rome he wrote his first successful novel, *The Improvisatore*. He wrote other novels, a book of travel, a number of plays, but it is for his *Fairy Tales*, first published in 1835, that he is remembered. These tales, a blend of the legends of the country around the old city of Odense with Andersen's fertile imagination, were immediately and universally popular. The author died near Copenhagen, Aug. 4, 1875.

BIBLIOGRAPHY.—*True Story of My Life*, trans. by Mary Howitt, 1926.

**ANDERSON, DICE ROBINS** (1880- ), American educator, was born in Charlottesville, Va., Apr. 18, 1880. He was graduated from Randolph-Macon College, 1900, and subsequently studied at the University of Chicago. After teaching in several schools and colleges, in 1909-20, he was professor of economics and political science at Richmond College, Va. From 1920-31 he was president of Randolph-Macon Woman's College. In 1932 he was made president of Wesleyan College. He is author of *William Branch Giles—A study in the Politics of Virginia and the Nation*, and of *Edmund Randolph, Second Secretary of State*.

**ANDERSON, ELIZABETH GARRETT** (1836-1917), English physician, was noted primarily as a pioneer for the professional education of English women. In 1860, at a time when a medical education for women was unheard of, she determined to study medicine. She had brief courses in the Middlesex Hospital in London, and studied privately with many professors at St. Andrews University and at Edinburgh. She had difficulty in obtaining a qualifying diploma to practice medicine, but finally obtained a license at Apothecaries' Hall in 1865. In 1866, she was appointed general medical attendant to a dispensary in London, founded to provide medical help for women by women. This developed into a new hospital for women in which she worked for more than twenty years. In 1870 she obtained the Paris degree of M.D., and by 1877 London University and other institutions began to admit women to medical degrees. In 1908 she was elected Mayor of Aldeburgh in England. She died at Aldeburgh, Suffolk, Dec. 17, 1917.

**ANDERSON, MARY** (1859- ), American actress, was born at Sacramento, Calif., July 28, 1859. After a début as Juliet in Louisville at the age of 16, she immediately played leading rôles in classic and modern dramas. In 1883-89 she attained her most notable success in London, appearing as Lady Macbeth, Galatea, Perdita, Rosalind and others. She retired in 1889, making her home in England, but ap-

peared in a revival in 1916 of *Comedy and Tragedy*, at Stratford-on-Avon, and the following year appeared in London in a benefit performance of *Pygmalion and Galatea*.

**BIBLIOGRAPHY.**—Mary Anderson, *A Few Memories*, 1896.

**ANDERSON, ROBERT** (1805-71), American soldier, was born near Louisville, Ky., June 14, 1805. After graduation at West Point, he served in the Indian wars and later in the Mexican war. In Nov., 1860, he was commander of Fort Sumter, in Charleston harbor, when it was besieged by the Confederates and which, after a terrific bombardment, in Apr., 1861, he was forced to surrender. He was given command of the Department of Kentucky and later of the Cumberland, with the rank of brigadier-general in the Union Army, but retired in 1863 as a result of ill health. He died at Nice, France, Oct. 27, 1871.

**ANDERSON, SHERWOOD** (1876- ), American writer, was born at Camden, O., Sept. 13, 1876. He pursued various occupations before becoming a writer. His books are naturalistic documents, dealing particularly with people of midwestern cities and villages. Many are frank studies of sex problems, and the author is at his best when depicting the struggles of inarticulate characters. Anderson's works include *Windy McPherson's Son*, 1916, *Marching Men*, 1917, *Poor White*, 1920, *Many Marriages*, 1922, and *Dark Laughter*, 1925, and *Beyond Desire*, 1932; among his short stories are *Winesburg, Ohio*, 1919, *The Triumph of the Egg*, 1921, and *Hello Towns!*, 1929. His autobiographical works include *A Story Teller's Story*, 1924, *Tar*, 1926, and *Notebook*, 1926.

**ANDERSON**, a city and the county seat of Madison Co., Ind., situated on the White River about 35 mi. northeast of Indianapolis. It is served by four railroads and by Federal and state highways. It is primarily an industrial center of which the development began in 1887 with the discovery of gas in the county. Its numerous manufactured products include automobile parts, tools, wire equipment; asphalt roofing, floor and wall tile, stoves; shipping-cartons and corrugated boxes; mattresses and bedsprings. In 1929 the industrial output reached a total of \$84,588,020; the retail trade amounted to \$20,800,824. In 1836 thirty-three acres of land were donated for "Anderson-town" on the site occupied prior to 1812 by Delaware Indians under Chief Kik-Tha-We-Nund. The Indian mounds of Anderson are among the best surviving specimens. In 1839 a town government was organized, and in 1865 Anderson was incorporated. Pop. 1920, 29,767; 1930, 39,804.

**ANDERSON**, a city in northwestern South Carolina and the county seat of Anderson Co.; situated in the foothills of the Blue Ridge Mountains, 32 mi. southwest of Greenville. Bus lines and several railroads serve the city. Cotton, corn, fruit and vegetables are the leading crops of the vicinity. The principal industry is textile manufactures. In 1929 the value of the factory output was about \$4,000,000; the retail trade amounted to \$8,406,333. Anderson was settled in 1827 and incorporated in 1828. The city is the seat

of Anderson College for women, founded in 1910; and nearby, on a site at one time belonging to JOHN C. CALHOUN, is Clemson Agricultural College, established in 1893. Pop. 1920, 10,570; 1930, 14,383.

**ANDERSONVILLE PRISON**, an open stockade near Andersonville, Sumter Co., Ga., used in the Civil War. The Confederate forces confined prisoners of war here from Nov. 1863 until the end of the war. Of the 49,485 prisoners held about 13,000 died from exposure, disease and insufficient food.

**ANDES**, a range of mountains in South America, from which rise the Amazon and the La Plata, two of the largest rivers in the world. The great fold range, broad in the north and consisting of several ranges with plateaus between, but narrowing to one main range in the south, is the most prominent continuous mountain system on the globe. For the entire length of the continent, from the Caribbean Sea to Cape Horn, a distance of over 4,400 mi., the titanic bulk of the Andes rears lofty pinnacles to maximum elevations surpassed only by the Himalayas. A nearly due south-north trend is maintained for about half the entire length from the Strait of Magellan to Arica, Chile, where a great north-westward trend is developed to the Gulf of Darien. But throughout this northern section the same and even greater symmetry is displayed, the rocky walls keeping closer to the sea and at some points plunging sheer to great depths. Because of this uniformity, Andes (*Antis*), the native (*Quichua*) name of the Peruvian section, was extended to the whole system by the Spaniards, to whom the westernmost range as far as Fuegia is known as the *Cordillera de los Andes*, or simply, the *Cordillera* in a preeminent sense. Its mean altitude, estimated at about 14,000 ft., is so uniformly maintained that, seen from the Pacific, the crest looks like a perfectly regular bastion surmounted at intervals by sharp or rounded pinnacles, representing old crystalline rocks or extinct or still active craters. The peaks, ranging from over 15,000 or 23,000 ft., are distributed with singular even-handedness throughout the whole system.

Region	Peak	Height in Feet
Bolivia	Sorata	21,484
	Illimani	21,203
Chile	Aconcagua	22,834
	Cima del Mercedario	20,877
	Tupungato	21,484
Peru	Huascaran	22,182
	Huandoy	20,841
	El Misti	19,162
Ecuador	Chimborazo	20,700
	Cotopaxi	19,498
	Antisana	18,851
	Cayambe	19,062
Colombia	Cocuy	17,500
	Tolima	18,400
Venezuela	Sierra de Merida	14,500

The system shows three chief divisions in its major outlines, the southern, middle and northern Andes. These differ considerably in relief and extent, as well as in influences on human activities.

**Southern Andes.** The comparatively narrow zone of the Andes which stretches from the southern border of the Puna de Atacama, in  $28^{\circ}$  S. lat., to the southern extremity of the continent, where it dips beneath the stormy Atlantic, is the most compact part of the system. It consists essentially of one main range in which lie both the greatest and least heights of the Andes; in  $36^{\circ}$  S. lat. occurs a distinct break in structure and also a transition between the arid Andes of northern Argentina and the more moist Patagonian Andes. But in respect to general topography the northern and southern sections may be considered as forming the southern Andes. Between its northern borders and northern Neuquen, the region reaches its greatest elevation, serves as the greatest barrier and is least habitable. A good part of the land lies well above 10,000 ft. culminating in volcanic peaks like Mount Aconcagua at 23,080 ft., the highest point in the western hemisphere. Slopes are steep and long. Numerous structural basins exist. Enormous piles of rock debris have accumulated and, owing to aridity, are removed slowly. In the south the region becomes lower and less continuous. Here glaciation has done considerable work; many glaciers still descend to the sea and produce great icebergs. The heavier rains, gentler relief and lower passes make this section far more attractive than the north. Its beautiful lake and mountain scenery attracts tourists.

**Middle Andes.** In structure, relief and human relations, that region of the Andes between northern Argentina and southern Colombia is the most complex portion of the ranges. Its chief uniformity lies in its considerable width and elevation; most of the region exceeds 10,000 ft. In the south, two main ranges inclose the elevated Altiplano which averages between 11,000 and 13,500 ft. in height. These converge north of Lake Titicaca in the Nudo de Vilcanota; northward the region comprises three major mountain ranges, interrupted again by the Nudo de Cerro de Pasco in central Peru and the Nudo de Loja in southern Ecuador, and separated by parts of the Marañon, Huallaga and Ucayali valleys. To the north of the Nudo de Loja follows the plateau of Ecuador which lies between two gigantic ranges. These merge in southern Colombia in the Nudo de Pasto before splitting into the three main ranges of the northern Andes. Despite height and ruggedness, the central Andes produce considerable agricultural wealth, and they constitute one of the richest mining regions in the world.

In outline, the central Andes falls into five sections; the western ranges; the Altiplano and Puna de Atacama; the High Pampas of Peru and Ecuador; the central range of Peru; and the eastern ranges.

The western ranges rise steeply from the adjacent coastal mountains and interior plains to elevations almost everywhere surpassing 10,000 ft. They contain some of the grandest volcanic peaks in the world, Chimborazo, Huascaran and Sajama rising to more than 20,000 ft. They are the greatest barrier to

transportation in South America, but they hold enormous mineral resources. The Altiplano of Bolivia is a vast intermontaine plateau or system of plateaus of gentle relief and largely of interior drainage. In the south, where aridity is greater, it contains extensive salt plains; but about Lake Titicaca, the huge freshwater lake which lies at an elevation of 12,508 ft., rainfall is sufficient to support some agriculture. Between the knots of Vilcanota and Pasto are a number of minor plateau areas, known as the High Pampas of Peru and Ecuador. They consist of inter-range depressions in which lie thick deposits of material washed from the mountains. These deposits, largely volcanic, give rise to soils of great fertility, so that these zones include some of the principal agricultural districts of the highlands. The central range of Peru is a great barrier to travel. On its western flanks are vast mineral deposits. The eastern ranges of the central Andes offer some of the most impressive mountain scenery in the world, the Cordillera Real of Bolivia, for example, averaging 20,000 ft. in height over a length of nearly 100 mi. In the long, fairly steep slopes to the interior plains they shelter rich agriculture regions; in minerals they vie with the other ranges, but only in Bolivia and southern Peru; the northern sections of Peru and Ecuador lack important mineralized areas. *See Minerals* (below).

**Northern Andes.** These ranges extend north and south in Colombia and bend eastward, parallel to the Caribbean coast in Venezuela. They have important mineral deposits, and include the chief centers of population in northern South America. In general they comprise three major subdivisions and their neighboring features: the eastern, central and western ranges. The western range is the lowest of the three, having a general altitude above the sea of between 8,000 and 9,000 ft. At its northern terminus it sinks gradually into the foothills which interrupt the surface of the Sinu-Cauca plains. For much of its length it is cut off from the Pacific by the valley of the Atrato River and by a low coastal range. Eastward and separated from the western range by the long Cauca valley, the central range is the highest large mountainous region of the northern Andes. For most of its extent it exceeds 10,000 ft.; the volcanic mountains Purace, Huila and Tolima reach 18,000 ft. At the north it widens out into a much lower zone which is one of the richest agricultural areas of Colombia. The eastern ranges have outstanding importance in the national economy of both Colombia and Venezuela. In both cases they contain the principal centers of population. Some sections, however, have been little developed chiefly because of their rugged nature. In the south the Cordillera Oriental extends from Ecuador almost to Bogota in one main range standing out in striking contrast to the Magdalena valley and the eastern lowlands. South of Bogota the highland broadens and extends northeast as a number of parallel ranges, between which are high savannas, level basin areas, between 8,200 and 8,600 ft. above sea level.



**Vegetation.** Almost everywhere in the Andean region north of central Peru the densely forested areas have been left mainly in their natural state. The forests themselves, consisting of mixed stands in which hardwoods predominate, have hitherto possessed little economic value, and accordingly there has never been any extensive lumbering except for mahogany in the northern part of Colombia and the northwestern part of Venezuela. The tropical forest regions on the slopes of the northern Andes and on the adjoining lowlands have seldom been entered except by seekers for gold in the streams, and by collectors of special products such as rubber, cinchona and tagua nuts. Cacao and coffee are cultivated up to moderate elevations in Ecuador, Venezuela and Colombia.

The natural vegetation of the Andes and of the Pacific slope from central Peru to Tierra del Fuego is on the whole scanty. The high mountains and plateaus support little plant life except the scattered moss-like *yareta* bush and *ichu* grass, and ribbons of chaparral and scrub along the water courses to the coast. The high lying pastures of the Peruvian Andes, most abundant in the region situated north of Lake Titicaca, support about 5,000,000 sheep in addition to large numbers of llamas and alpacas. Forests of rather low commercial value, mainly of beech, laurel and cypress, occur in the Chilean Andes.

**Minerals.** For centuries minerals have been a great source of wealth in the Andes. Even now many centers in the mountains depend solely on the mining industry. The lack of coal in many mining districts of the Andes, and of firewood also in the whole central section where minerals are abundant, has been a factor retarding the development of mining in proportion to the undoubted wealth of the deposits. The inaccessibility of deposits, bound up in mountain fastnesses, is another reason for the relatively slow development of the industry. The leading mineral produced in the Andes, in point of value and quantity, is copper. A particularly rich belt runs from Cerro de Pasco, Peru, down to Aconcagua (formerly O'Higgins) Province, Chile. Corocoro, Chile, is another copper mining center. Gold occurs in the mountain districts of Venezuela, Colombia, Ecuador and Peru. Silver is found mainly in the central Andes, particularly in Peru. Tin, which is often found with silver, is supplanting the mining of silver in Bolivia. The Colombian Andes is one of the leading areas in the world in the production of platinum. Vanadium is found in Peru, in the western part of Junin Province. Bismuth is mined in Bolivia and borax in Chile, and deposits of sulphur, tungsten, molybdenum and mercury are found in other parts of the Andes.

**Climate.** Varying altitudes give varying temperatures. At certain altitudes the temperature is that of perpetual spring, for each 330 ft. of ascent reduces the temperature by 1° F. Between 4,000 and 9,000 ft. it is mild or cool, and at these altitudes the greater part of the people (north of Chile) make their

homes. Above 10,000 ft. the chief characteristic of the climate is its discomfort. The land during the day may become fairly warm in the sun despite the altitude, but at night temperatures drop abruptly. During the winter the cold is alleviated somewhat by the aridity. In much of the region freezing temperatures may be expected throughout the year. The growing season for even the hardier crops is short. Practically nowhere, except on the lower eastern slopes in the Amazon region, does annual precipitation exceed 25 in., but the east receives more than the saline lands of the southwest.

**Inhabitants.** Though some 8,000,000 people are estimated to live in the Andean zone proper, the proportion of whites is generally very low, and the number of whites and *mestizos* taken together smaller than that of the Indians. The latter are stolid, indifferent to progress and live at a very low standard. The whites and the *mestizos* who pass for whites form a sort of propertied aristocracy for whom the Indians are expected to work. There is no peasant farmer class in the Andes, and this acts as an obstacle to a prosperous type of agriculture among the scattered communities of the region. The Indians were reduced to slaves by the Inca system. The Spanish colonial policy helped to continue this servitude and by its method of parceling out land, made it impossible for Europeans to settle in any considerable numbers. In recent years mining companies of European or North American origin have made extensive developments, and through the introduction of railroads, machinery and modern business methods, are working important transformations.

**ANDESITE**, a fine-grained IGNEOUS ROCK, light grayish to greenish in color. The essential minerals are plagioclase FELDSPAR, andesine or oligoclase, HORN-BLENDE, AUGITE and BIOTITE. All these occur in minute crystals, except that feldspar often forms larger ones, or PHENOCRYSTS. It is the rapidly cooled, usually extrusive, form of DIORITE. A red porphyritic rock, the *porfido rosso antico* of the ancient Egyptian quarries, was a rare variety of andesite. The name is derived from the Andes where, as in the Coast Ranges and the Rocky Mountains, it is a conspicuous rock formation. It is sometimes used for building purposes. See also PETROLOGY; PORPHYRY; DACITE.

**ANDIZHAN**, administrative center of Andizhan district of the Uzbek S.S.R., a rapidly growing commercial and industrial city, 85 mi. northeast of Kokand. It was the former capital of Kokand khanate. In 1902 it was destroyed by an earthquake, but was rapidly rebuilt. It is the center of an important cotton district and is the terminus of the Andizhan Railway. Pop. 1926, 73,466.

**ANDORRA**, a small autonomous state, situated in the eastern Pyrenees on the frontier between France and Spain. It has a territory of about 185 sq. mi. The country consists of a number of small mountain valleys enclosed by peaks which rise from 5,000 to 8,000 ft. in height. Live stock breeding is the chief industry. The animals include sheep, goats, cattle

and horses. The soil is not well adapted to the growing of cereals but tobacco thrives and represents the chief source of wealth. The state is governed by an elected council. The postal service is under Spanish control and the other public services are under French supervision. Andorra la Viéja, with a population of 600, is the capital. Pop. 1931, 5,231.

**ANDOVER**, a town in Essex Co., northeastern Massachusetts, situated in the Merrimac Valley, about 3 mi. south of Lawrence. The Boston and Maine Railroad and bus lines afford transportation. Abundant water power for local industries is supplied by the Shawshen River. The American Woolen Co. has established here a model community, producing yarns, woollens and worsteds. Phillips Andover Academy for Boys, opened in 1778, and the Abbot Academy for Girls are located here. Andover was settled about 1643 and incorporated in 1646. Pop. 1920, 8,268; 1930, 9,969.

**ANDRADA E SILVA, JOSÉ BONIFACIO DE** (1765-1838), Brazilian statesman, geologist, poet and orator. He is called the "Father of Modern Brazil." Born in Santos, Brazil, in 1765, of a noble Portuguese father and a distinguished Paulista mother, he received his education at the University of Coimbra in Portugal, specializing in mineralogy and metallurgy. Commissioned by the Portuguese government to make a scientific expedition throughout Europe from 1790 to 1800, he visited many countries, became a member of several outstanding scientific societies and contributed to their journals. In Sweden he discovered a number of unknown minerals. He became a friend of Alexander von Humboldt and of other modern scientists of the period. When he returned to Lisbon he occupied several positions of importance in the academic and political life of the country. In 1819, however, he returned to his native land where in a few years he was to perform a unique service for his country.

He first devoted himself to research and study but when the movement for independence began Bonifacio became the center, the director and controlling mind. In 1821, 1822 and 1823 Bonifacio and his distinguished brothers, Martin Francisco and José Antonio played rôles that gave to Brazil an evolution quite different from that of the neighboring Spanish nations. Bonifacio it was who convinced the Prince Dom Pedro to remain in Brazil and who led and advised him. Bonifacio organized the *Junta* of São Paulo, called for deputies from the various provinces and persuaded the prince to accept the Grand Mastership of a Masonic Lodge pledged to creating a monarchy rather than a republic. Of all the South American national "fathers" Bonifacio is the only one who was not a soldier. Furthermore, he seems to have had a much clearer perception of his country's needs than most of the others and sought to solve the Brazilian problem with a Brazilian solution.

Bonifacio formulated the policies which solved the major problems in a peaceful and bloodless manner, and his triple program constitutes his claim to the title, "Father of Modern Brazil." He advised the

adoption of a limited constitutional monarchy as the best bridge from colonial subjection to republican freedom; and in two remarkable essays, clearly seeing the economic fallacy of slavery, he proposed the gradual emancipation of the slaves and the means for civilizing the Indians. The first part of this program was established in 1822 when Brazil became a free limited monarchy, under the Emperor Dom Pedro I (*see* BRAZIL). Bonifacio, however, was arbitrary and opinionated, and in 1823 he was exiled abroad. After his removal from the cabinet in the early days of the monarchy and before his exile he founded and contributed to the newspaper *Tamoyo*. Though he was not on the committee which drew up the constitution of 1824 his brother Antonio Carlos was a member, and the document embodied many of Bonifacio's ideas. His last public service to Brazil was the tutorship of young Dom Pedro II in 1831 but this led to opposition and he was again exiled to a Brazilian island, where he died in 1838.

Bonifacio was one of Brazil's greatest orators and a poet of extraordinary merit. Under the pseudonym, "Américo Elysion," he wrote poetry while in exile in Bordeaux, France. His programs in regard to the Indian and Negro are found in *Apontamentos para a Civilização dos Índios* and *Representação a Constituinte Sobre a Escravatura*. P. V. S.

**ANDRÁSSY, JULIUS, COUNT** (1823-90), Hungarian aristocrat and statesman, was born at Kashau, Slovakia, Mar. 3, 1823. After the defeat of Austria in the Austro-Prussian war of 1866, Andrassy worked with Déak for the autonomy of Hungary. The Dual Monarchy was established, Hungary becoming a partner on equal terms with Austria. Andrassy was appointed by Francis Joseph the first Prime Minister of Hungary under the new constitution and continued for several decades to be one of the most influential statesmen of the Dual Monarchy. He gave particular attention to foreign affairs and in 1879 he negotiated the Austro-German alliance with Bismarck. Andrassy's popularity waned after his seeming failure at the Congress of Berlin, and his acceptance for the Empire of the mandate over Bosnia and Herzegovina. Andrassy finally resigned his office, but continued in the Upper House to promote his plans for constitutional reform. He died Feb. 18, 1890, at Volosea near Fiume.

**ANDRÁSSY NOTE**, a strongly couched recommendation to the Turkish Government for reforms in the disturbed provinces of Bosnia and Herzegovina, drawn up by Count Julius Andrassy, foreign minister of Austria-Hungary. The note, dated Jan. 31, 1876, was subscribed to by Austria-Hungary, Germany and Russia, and also had the diplomatic approval of Great Britain and France. The document was an unsuccessful attempt to bring about equality between the Christian and Moslem subjects in the Turkish provinces, by the abolition of the system of farming the taxes, and the establishment of partial autonomy through a local assembly representing both religions. It was in effect an ultimatum by Christian powers demand-

ing of Turkey modern reforms in Bosnia and Herzegovina. Although all the recommendations save one were accepted by the Porte, the whole program of reform was abandoned with the Bulgarian Massacres, 1876, and the Russo-Turkish War which followed.

**ANDRÉ, JOHN** (1751-80), British officer, was born at London, England, in 1751. He entered the army at 20 and in 1774 joined the Royal Fusiliers in Canada. His rise was rapid and in 1778 he was made adjutant-general with the rank of major and aid to Sir Henry Clinton. In 1780 he conferred with BENEDICT ARNOLD for the surrender of West Point. He ascended the river in the British sloop-of-war *Vulture* and was allowed to land under a flag of truce. But later the vessel was forced back down the river by gunfire from the forts. André spent the night in the fort, and next day started for the British camp in civilian attire on horseback, but he was arrested at Tarrytown and searched. Proofs of the negotiations were found and he was court-martialed on Sept. 29, 1780, found guilty, and hanged at Tappan, N.Y., Oct. 2, 1780.

**ANDREA CHÉNIER**, an opera in four acts by UMBERTO GIORDANO, libretto by Luigi Illica; première, Milan and New York, 1896, London 1903. The story is based on the life of Marie André Chénier (1762-94), French poet and patriot who lost his life on the scaffold during the French Revolution.

Rivals for the hand of Madeleine, daughter of the Countess de Coigny, Gerard, a servant, and Andrea Chénier come to blows. The former, an admirer of Robespierre, is wounded by Chénier who at length is captured, tried by the Revolutionary tribunal, and sentenced to death for his political sympathies. Gerard himself writes the fatal indictment. Offering to yield himself to Gerard if he will stay the execution of his rival, Madeleine does all in her power to save Chénier, but the plea comes too late. Although Gerard now declares the original indictment false, the bloodthirsty mob refuses to be cheated of its vengeance, and Chénier, accompanied by Madeleine who has bribed the jailer to substitute her for another prisoner, goes to the scaffold.

**ANDREA DEL SARTO** (1486-1531), Italian painter, was born in Florence, July 16, 1486. His real name was probably Andrea Vanucchi, but he was nicknamed del Sarto, meaning "of the tailor," from his father's profession. Andrea del Sarto worked for several years under Piero Cosimo. His first important works were three frescoes depicting scenes from the life of St. Filippo Benizzi and executed about 1510 for the Servites in the church of the Annunziata, Florence. Much influenced by Michelangelo, the young artist gradually developed his own realistic style. Known as the "flawless painter," he was greatly in demand as a fresco painter. In 1516 Andrea married Lucrezia del Fede, whom he frequently painted. The years 1518-20 were spent in the services of Francis I of France. Del Sarto's masterpiece is undoubtedly the lunette, *Madonna del Sacco*, painted about 1525 in the Servite cloister at Florence. Among

his other works are many religious paintings and several notable portraits. His finest paintings now hang in the Uffizi Gallery and the Pitti Palace at Florence and in the Louvre, Paris. The artist is best represented in the Metropolitan Museum, New York, by a *Holy Family*. Andrea del Sarto died in Florence, Jan. 22, 1531.

**ANDREINI, GIAMBATTISTA** (1578-1650), an Italian actor and dramatist, was born at Florence in 1578, of a distinguished family of actors and poets. He acted in France, Germany and Italy and wrote a number of comedies and several religious dramas. One of the latter, *L'Adamo* (1613), has been suggested by Continental critics as Milton's source of the material for *Paradise Lost*. He died at Paris in 1650.

**ANDREW, ST.**, one of the 12 disciples of Jesus. The fourth Gospel gives us most of our knowledge of him, the Synoptics saying little. A Galilean fisherman of Bethsaida, he early followed John the Baptist. Meeting Jesus, he led his brother, Simon Peter (*see* PETER, SAINT), to him. Outside of the Gospels, he is mentioned only once, in Acts 1:13. Early Christian writers, notably Eusebius, St. Gregory of Nazianzus, St. Jerome, Theodoret and Nicephorus make him an Apostle to the Scythians, later appointing St. Stachys as the first bishop of Byzantium. The Acts of St. Andrew, a 2nd century MS., says that he was a martyr



SAINT ANDREW SHOWING HIS CROSS  
By the German master engraver "E. S."

by the order of the Roman governor Aegeas, during the reign of Nero, 60 A.D., at Patrae in Achaia, being crucified on a decussate cross (X), since named for him. His relics are reputed to be in the Cathedral of Amalfi in Italy. The Scotch accept him as their patron saint, and the Russians honor him as the founder of their Church. Latin, Greek and Anglican churches commemorate him on Nov. 30.

**ANDREWS, CHARLES McLEAN** (1863- ), American historian, born at Wethersfield, Conn., on Feb. 22, 1863. He was educated at Trinity College, Hartford, Conn., graduating in 1884, and at Johns Hopkins University, receiving his Ph.D. in 1889. In the department of history he remained at Bryn Mawr College during 1889-1907. He was professor of history at Johns Hopkins from 1907 to 1910, going to Yale in that year to be professor of American history until 1931. In 1931 he became director of historical publications at Yale, having been one of the editors since 1912. He was a member of the Public Archives Commission, 1901-15; of the committee on documentary publications, United States Government, 1907-08 and 1922-29; and chairman of the committee on transcripts from foreign archives, 1905-28. His published works include: *Old Houses of Connecticut*, 1921; *The Colonial Background of the American Revolution*, 1924; *Fathers of New England* and *Colonial Folkways* in "Chronicles of America" series, 1919; *The Colonial Period of American History*, 1912; *Contemporary Europe, Asia, and Africa*, 1902; and contributions to the *Cambridge History of the British Empire*, 1929.

**ANDREWS, ROY CHAPMAN** (1884- ), American explorer and paleontologist, born at Beloit, Wis., Jan. 26, 1884. He was educated at Beloit College, from which he went to the American Museum of Natural History. In 1908 he was connected with an Alaskan exploration expedition; in 1909-10, he worked as a naturalist in the Dutch East Indies, Borneo and Celebes; in 1911-12, he was in Korea; in 1913 he went to Alaska. In 1917, he was leader of an expedition of the American Museum of Natural History to South West China; in 1919, he led a second expedition to Mongolia; and, in 1921-29, he led a third to Mongolia and Central Asia. He has discovered great fossil fields in Mongolia, found the first dinosaur eggs, and mapped large areas of the Gobi Desert. His books, records of his adventures, include *Whale Hunting with Gun and Camera*, *Camps and Trails in China*, *Across Mongolian Plains*, *On the Trail of Ancient Man*, *Ends of the Earth*.

**ANDREYEV, LEONID NIKOLAEVICH** (1871-1919), Russian writer, was born at Orel, in Central Russia, Aug. 9, 1871. He studied law and received his diploma from the University of Moscow in 1897, but the practice of law was so distasteful to him that he soon abandoned it to become a police court reporter for a Moscow paper. His first short stories appeared in the daily press and created such favorable comment that he soon began to publish essays and dramas. The first collected edition of his stories was published in 1901, and within a short time a quarter of a million copies had been sold. Andreyev has remained one of the most popular and talented of modern Russian authors. His work has been translated into all the European languages and into English. Among the dramas are *The Life of Man*, *Lazarus*, *Katerina*, *Anathema* and *He Who Gets Slapped*. His fiction includes *The Red Laugh*,

*The Seven That Were Hanged*, *The Little Angel and Other Stories*, *The Crushed Flower and Other Stories*, and *Silence and Other Stories*. In 1914-15, before his disillusionment with Russia and the Allies, he wrote *King, Law, Liberty*, a play, and *War's Burden*, a novel, but they were intended for propaganda and did not approach his old art. He died in Finland, Sept. 12, 1919.

**ANDROMACHE**, a Greek heroine. She was a daughter of Eetion, king of Thebes in Cilicia. On taking the city, ACHILLES slew her father and seven brothers, but he accepted ransom for her mother and returned her to her own home, where she died, slain by the arrows of ARTEMIS. Andromache was married to HECTOR, the Trojan hero, and bore a son, Astyanax. During the siege of Troy Hector was slain and Astyanax was thrown from the walls. Andromache became the captive of Neoptolemus or PYRRHUS, son of Achilles. Later she was married to Helenus, a brother of her first husband, Hector. According to tradition she died at Pergamos in Asia Minor.

**ANDROMEDA**, the daughter of the Ethiopian king, Cepheus, and of Cassiopeia who boasted that in beauty her daughter surpassed the Nereids. Complaint was made to POSEIDON, who as lord of the ocean caused the country to suffer a flood and the ravages of a sea monster. In response to an oracle, Cepheus obtained relief by chaining Andromeda to a rock, where she was rescued from the monster by PERSEUS, who made her his wife.

**ANDROMEDA** (gen. *Andromedae*), named after the daughter of Cepheus and Cassiopeia in the ancient myth, is a northern constellation formed chiefly by three stars of the second magnitude. The first of these, Alpha, constitutes the northeast corner of the square of Pegasus; the second, Beta, is red in color, while the third, Gamma, is a beautiful triple star. North of Beta may be found the Andromeda Nebula, a SPIRAL NEBULA and the only one of these visible to the naked eye. This "Island universe" is nearly one million light years distant. See STAR: map.

**ANDROMEDIDS**, a swarm of METEORS, forming the remains of what once was Biela's comet, but whose orbit around the sun is now so altered through PERTURBATIONS that they are no longer visible in conspicuous numbers from the earth.

**ANDRONICUS, LIVIUS**. See LIVIUS ANDRONICUS.

**ANDROS, SIR EDMUND** (1637-1714), English colonial governor in America, was born at London, Dec. 6, 1637. As an army officer with influential connections at the court of Charles II, he secured, in 1674, an appointment to be Governor of New York and regions between the Connecticut and Delaware rivers, though his rights over Connecticut and the Jerseys were disputed. The attempt at establishing a dominion on the forfeiture of the New England charters made him Governor-General, in 1688, of the "Dominion of New England" which included not only New England proper but also New York

and the Jerseys. This pretentious vice-royalty collapsed with the GLORIOUS REVOLUTION in England, and Andros was arrested in 1689 with several officers and sent to England for trial, but there was released. In 1692-98 he was Governor of Virginia, but quarrelsomeness brought this administration to an end. He died at London, Feb. 1714.

**ANDROS**, an island of the West Indies, in the British Bahamas. It is about 90 mi. long and from 10 to 40 mi. broad. For the most part it is low and swampy but it is well-timbered. Often it is subject to overflow by the sea. Lagoons and marshes divide the island into three main sections and into a number of smaller ones. Because of this it is often spoken of as a group of islands. Wool and sponges are the principal articles of commerce. The population in 1931 was 7,071, most of them living in Red Bays at the north end.

**ANDROS** or **ANDRO**, an island of the CYCLADES group in the Aegean Sea. Several mountain chains cross its area of 160 sq. mi., between which are valleys in which olives, grains and fruits are grown. The early inhabitants were Ionians and Thracians and its ancient capital was Palaepolis, in which was a temple to Bacchus. During the 7th century Andros sent out colonists to Chalcidice. It was a member of the Delian League, but revolted from Athens in 411 B.C. Later it fell to Macedon and in 133 B.C. to Rome. Andros was under the protection of Venice from 1207 to 1566, when it was taken by the Turks. The island is now an eparchy of Greece and the city of Andros is its capital.

**ANDROSCOGGIN RIVER**, a river in Maine, formed by the junction of the Magalloway River and an outlet of Umbagog Lake in the White Mountains, New Hampshire. It flows through Coos Co., N.H., crosses the western boundary of Maine, and continues east and southeast until it joins the Kennebec River about 18 mi. above the mouth of the latter and 5 mi. above Bath. The area drained is estimated at 3,698 sq. mi. and is a region densely forested and spotted with lakes. Although only 160 mi. long, the Androscoggin River has a total fall of 1,256 ft. and is a valuable source of water power. At Rumford, Lewiston, Auburn and other points on its course this power has been utilized for industrial purposes.

**ANEMIA**, a reduction in the amount of the hemoglobin or red coloring material of the circulating blood. The intensity of the condition varies from minor changes to a reduction in the hemoglobin which is 80 to 85% below normal. The term "anemia" is a general one and includes many different types which are entirely separate diseases, having in common only the decrease in hemoglobin. The latter may be due to a diminished amount of hemoglobin in each red blood cell, or the amount per cell may be normal and the anemia result from a decrease in the red blood cells below the normal number of 5 million per cubic millimeter for men and 4.5 million for women. In the grave types of the disease, the red blood cell count may be below 1 million per cubic millimeter.

The usual symptoms which are dependent upon the anemia itself, regardless of the type, are pallor, shortness of breath, palpitation of the heart and sometimes swelling of the ankles. It should be emphasized that pallor alone does not necessarily indicate the presence of an anemia. Some individuals are congenitally pale, although their blood is normal and temporary pallor may be associated with undue fatigue or a fainting attack, at which times there may be a transient diminution of blood in the skin as a result of constriction of the blood vessels. A persistent pallor, which develops in a person who has previously had a normal color, suggests the possibility of an anemia.

The degree of anemia can be accurately estimated by the examination of a drop of blood obtained from the lobe of the ear or tip of the finger. The hemoglobin content is determined by comparing the color of the blood with a permanent standard and expressing the result in percentage of normal. By means of a special apparatus the number of red blood cells may be counted with the aid of a high power microscope. Another valuable laboratory method of studying the blood is to permit a drop to spread between two thin glass slides and, after drying for a few minutes, to apply one of the specially prepared blood stains. From a careful study, an experienced observer may secure helpful information by noting the various changes which occur in the formed elements of the blood, viz: the red blood cells, the white blood cells and blood platelets.

As previously emphasized, there are many different types of anemia and these vary widely in their causes, symptoms, treatment and the outlook for recovery. Any attempt to classify them is associated with difficulty and is confusing to the non-medical reader. The general terms primary and secondary anemia, however, are often used and fulfill a useful purpose. A *secondary anemia*, of which there are many kinds, means an anemia which is secondary to some type of chronic disease or following hemorrhage. Many chronic diseases have such an anemia as a complication, the most common being cancer, tuberculosis, Bright's disease and some of the acute infections such as typhoid fever, rheumatic fever, sepsis and malaria.

The *primary anemias* are few in number and may be defined as anemias which arise from unknown causes. Included in this group are CHLOROSIS, a now infrequently encountered anemia of young adult girls which is attributed to poor hygiene, and *pernicious anemia* (Addison's or Biermer's anemia) which occurs more commonly and is a disease of major importance. The decision as to whether an anemia is to be classified as a primary or secondary type, depends upon the presence or absence of a recognizable cause, as cancer, for example, and the character of the changes in blood as determined by an experienced observer.

The rational treatment of the anemias must be preceded by a careful study of the individual patient in order to determine accurately the exact variety of the disease, for the treatment varies accordingly. Any

attempt at self-medication by the patient should be discouraged as an improper form of treatment may be used, which not only fails to produce the desired result, but during this time there may be a change from a readily controlled condition to one in which the outlook is hopeless. The anemia following hemorrhage, which is most frequently associated with trauma (gunshot wounds, various accidental injuries, etc.), bleeding peptic ulcer, complications incident to childbirth, and hemorrhoids, should first be treated by controlling the source of bleeding. In acute hemorrhage, when the bleeding has been stopped, it may be desirable to resort to the transfusion of a pint or more of blood. Having controlled the bleeding, various measures are employed to assist the body in forming blood at an increased rate. For this purpose an abundant, well balanced, nutritious diet, and preparations of iron, are used.

In various types of secondary anemias, the most important therapeutic measure is to remove, if possible, the underlying cause, whatever it may be. In chlorosis there is a specific cure in the form of large doses of iron. Removal of the spleen is followed by excellent results in rare forms of anemia of a congenital nature and in some types of purpura, a disease characterized by a spontaneous tendency to bleed into the subcutaneous tissues and mucous membranes.

The greatest advance in the treatment of the anemias dates from 1926 when liver, and later an extract derived from this organ, was introduced as a method of treating pernicious anemia. More recently it has been discovered that dried hog's stomach has the same striking effect. When these substances are given to a patient who is critically ill with pernicious anemia, the effect is remarkable, for within a few days there is a striking increase in appetite and gain in strength and a rapid disappearance of all symptoms of the anemia.

The symptoms which are due to changes in the nervous system are much less favorably influenced. Although these substances produce marked improvement in patients with pernicious anemia, it cannot be said that they are a cure in the strictest sense of the word, as a patient must continue their use indefinitely in order to avert a relapse. C. C. S.

**ANEMOMETER**, an instrument for measuring the speed of the wind or of other air currents. Mechanical anemometers are modified-windmill structures in which the number of revolutions is proportional to the length of the air column which has flowed past the instrument. The U.S. Weather Bureau uses a Robinson cup anemometer (Fig. 1) of standard construction in which a definite number of revolutions corresponds to the passage of an air column of a certain length. For recording or indicating instruments the rotating parts of a small dynamo are mounted on the cup shaft and connected to a voltmeter which is calibrated to read wind velocities directly in miles per hour.

For portable purposes, vane-type instruments (Fig. 2) are used. The length in feet of the air column

which has passed the instrument is recorded on the dials and the time required noted with a stop-watch.

The PIROT TUBE with a calibrated, differential-pressure gauge is used extensively as an air-speed indi-

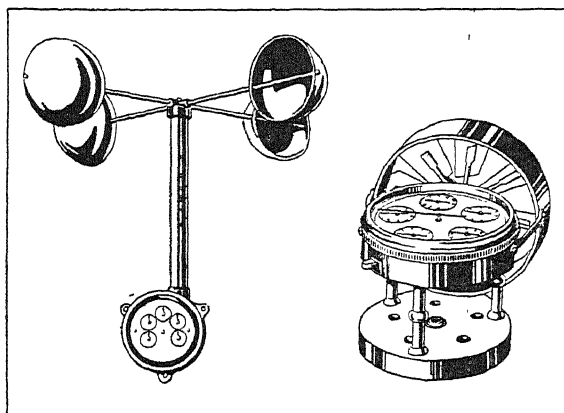


FIG. 1

FIG. 2

cator for airplanes. The VENTURI METER may also be used for this purpose, but it is more subject to errors due to turbulence.

Very low air speeds may be measured by determining the rate at which heat is lost from an electrically heated wire.

A. A. K.

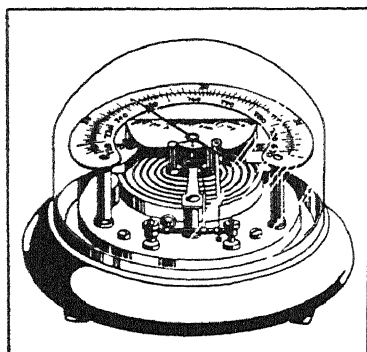
**ANEMONE**, a numerous genus of perennial herbs of the crowfoot family many of which are commonly called windflower. Defined in broad sense there are fully 100 species, native chiefly to the north temperate zone, several of which are grown for their attractive bloom. About 25 species occur in North America; among these are some of the most beautiful native wildflowers. They are usually low, short-stemmed plants with lobed or much divided root leaves and two or three stem leaves which form an involucre below the flowers. These are mostly showy with a wide range of colors from red to purple, blue, yellow and white. Among the most popular garden anemones are the pasque flower (*A. Pulsatilla*) with violet-purple flowers 2½ in. broad; the poppy anemone (*A. coronaria*) with red poppy-like flowers varying to blue and white; the broad-leaved anemone (*A. hortensis*) with flowers of various colors; the scarlet anemone (*A. fulgens*) with vivid scarlet flowers; the snowdrop anemone (*A. sylvestris*) with pure white, nodding, fragrant flowers, and the Japanese anemone (*A. japonica*), a stout, hairy plant 3 ft. high, bearing very showy flowers, 3 in. across, blooming in autumn.

**ANENCTETUS** or **ANACLETUS**, ST., second bishop of Rome, 77-88 A.D. It has been held by some that he is the same as CLETUS. Anenctetus is called a martyr in some of the old martyrologies.

**ANEROID BAROMETER**, an instrument for measuring atmospheric pressure. It consists essentially of a vacuum chamber having two opposite elastic metal sides and an indicating mechanism. The elastic sides are pushed outward by a spring and inward by



the pressure of the air, their position being indicated by a pointer and dial in such a manner as to give a direct pressure reading. Where convenience is more important than accuracy, the aneroid barometer may be



ANEROID BAROMETER  
*Demonstration model, showing working  
parts of the instrument*

employed, but where highly accurate measurement is desired, the mercury barometer is used. *See also* BAROMETER.

**ANESTHESIA**, a state of insensibility to touch or pain. The use of the term is generally confined to a condition produced artificially to render the body or portions of it insensible to surgical manipulation, although it may properly be used to apply to a lack of sensation of any sort. Anesthesia may be general or local, depending upon whether the entire body or a portion of it is acted upon.

*General anesthesia* is the result of the action of the anesthetic agent upon the brain. ETHER is now the usual agent, although CHLOROFORM was once popular. Previous to the introduction of these agents in 1846 and 1847, operations were made endurable by the taking of large quantities of alcohol, or by the use of opiates. Nitrous oxide is useful in obtaining anesthesia rapidly for operations of short duration. Hypnotics in large doses act as anesthetics, but usually they are administered in small doses to produce sedation and to act as preliminary medication for other anesthetics.

General anesthesia usually acts in three successive stages. The first stage is characterized by vertigo. In the second stage the patient may be excited or nauseated, but this stage is frequently passed through without either of these symptoms. In the third stage the patient becomes quiet, the muscles relax, respiration becomes quiet and regular, sensation disappears and there may be a characteristic effect on the size of the pupil. As the patient recovers, he passes through the described stages in reversed order.

Chloroform and ether are generally administered by being dripped on a cloth-lined, cone-shaped frame which fits over the nose and mouth, loosely if chloroform is being used, and snugly if ether is employed. Ethylene and nitrous oxide, which are gases, are mixed with pure oxygen in a breathing bag and administered from it through a tube and mask to the

patient. Ether is usually used in an admixture with gases. General anesthetics may be administered in certain circumstances by inhalation through a tube which is passed through the nose or mouth into the trachea. Some men go so far as to produce general anesthesia by the injection of a general anesthetic into the spinal canal, so that it will eventually reach and stupefy the brain. General anesthetic agents may be placed in the rectum, from which they are absorbed into the circulation and so affect the brain. Before administering an anesthetic, it is advisable to ascertain whether the patient is suffering from diabetes, chronic kidney disease, or disease of the lungs.

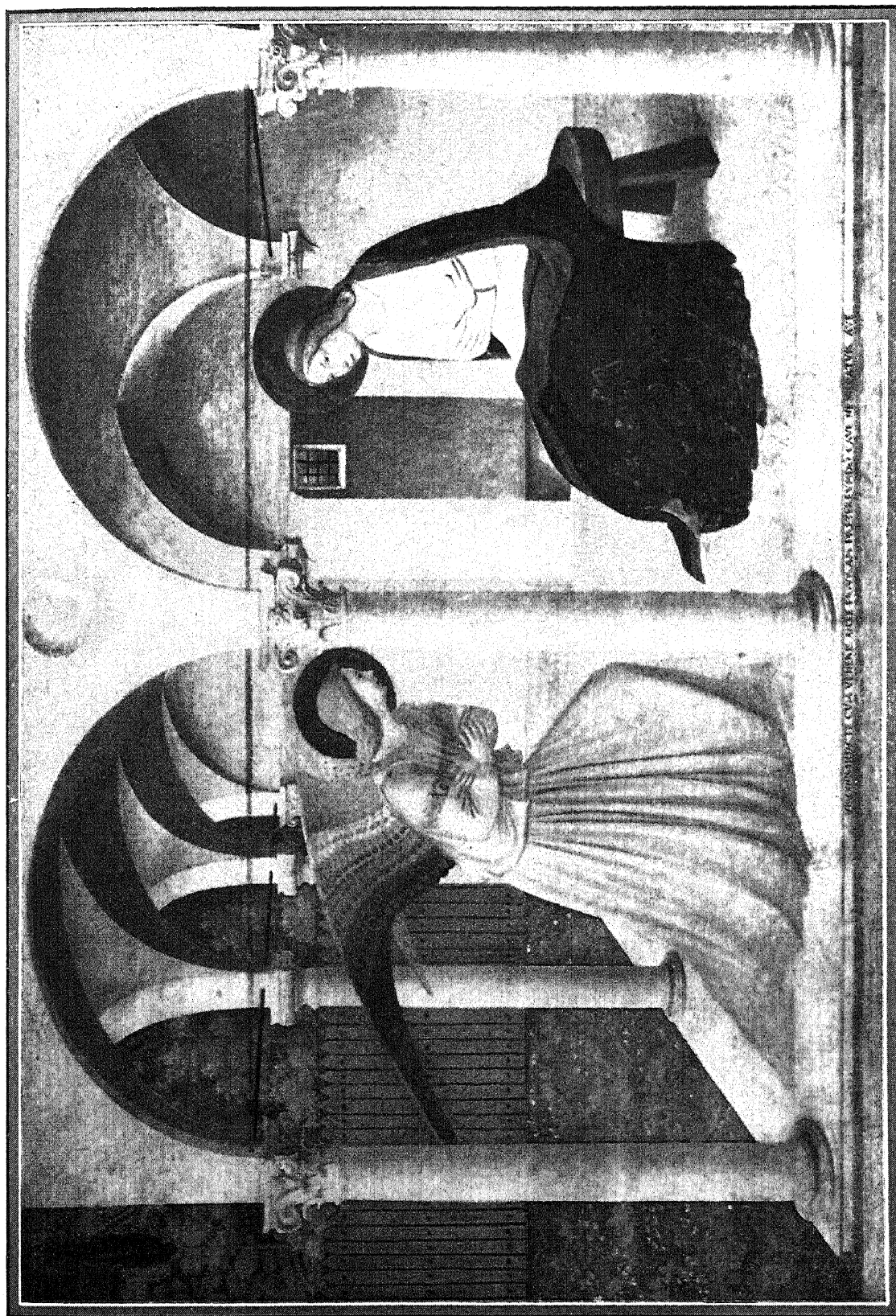
*Local anesthetics* paralyze the sensory nerve endings or, if applied to the nerve trunks, block conductivity. When injected into the spinal fluid, they paralyze the patient's body and legs below the level of the injection, and make these parts insensible to pain. Local anesthesia is usually carried out by infiltrating with solutions of cocaine or its derivatives, or with procaine, into or around the site of operation. Local anesthesia methods are frequently used in operations on the eye, nose and throat, and in these cases cocaine and procaine are the agents generally used. *See also* CHLOROFORM; COCAINE; ETHER; ETHYLENE ANESTHESIA; GASES AND ATMOSPHERES, INJURIOUS; NOVOCAINE.

J. S. L.

**ANEURYSM**, a dilation of the wall of an artery due to a weakening of the tissues of which it is composed. The weakened tissues stretch so that there is a distortion of the diseased blood vessel. There may be a diffuse dilation of the artery or, if only a portion of the circumference is affected, the dilation will have a bubble-like or sacular form. Aneurysms occur most frequently in the aorta, and usually in that portion of the aorta which lies close to the heart and just above it. The arteries of the brain and those of the extremities are also occasional sites of aneurysm. Aneurysm of the heart may occur. A dissecting aneurysm is a variety which does not necessarily involve dilation of the artery. The lining of the arterial wall is split and blood passes in between the layers of the lining membranes. Syphilis is much the most common cause of aneurysm. Bacterial infections and rheumatic fever account for a few, and likewise arteriosclerosis. Aneurysm of an artery may also occur if the artery receives a violent blow.

The danger from aneurysm lies in the fact that the weakening and stretching of the arterial wall eventually leads to rupture. A small artery in the brain may thus give rise to apoplexy. If a large artery in one of the limbs should rupture there might be serious bleeding beneath the skin and the blood supply of the limb might be seriously interfered with, so that gangrene might occur. When the aorta is affected, pain is usually felt, due to the pressure of the swelling upon the ribs or vertebrae. Pressure upon the trachea sometimes causes difficult breathing. At times an aneurysm of the aorta may reach a very fair size without symptoms being produced, simply because it happens to avoid pressure upon any of the

ANGELICO, FRA



“THE ANNUNCIATION”

By Fra Angelico (1387-1455). In the Museum of San Marco, Florence.



adjacent tissues except the lung, which is easily compressible and is insensitive. Rupture of an aortic aneurysm is, of course, promptly fatal from internal hemorrhage. H. E. B. P.

**ANGARY**, a right which rose at ROMAN LAW that authorized the seizure of horses and wagons, and was at length extended to include the requisition of neutral shipping for the carriage of troops. Thus, neutral merchantmen in belligerent harbors and their crews could be seized to carry troops and munitions of war, where freight was paid in advance. The right fell into disuse, and was prohibited by some treaties. During the World War the practice was resumed. On Mar. 31, 1918, President WOODROW WILSON declared that imperative military needs of the United States required the immediate utilization of the Dutch vessels then lying in American TERRITORIAL WATERS. The seizure was authorized under the promise to make full compensation according to the principles of international law. Seventy-seven Dutch ships were seized under this order, for which the United States paid \$12,239,852.47, under an award of the Permanent Court of Arbitration at The Hague. C. E. M. A.

**ANGEL**, in the English language usually the denotation of a supernatural being. It is a transcription of a Greek word, similarly formed, meaning a messenger. In the Bible it is used for both human and superhuman beings, and no emphasis is laid on their character, whether good or evil. In the Old Testament an angel is frequently a manifestation of God in human form, but when the Hebrews came under the influence of the Persians their angelology acquired a more definite character. Their angels, while countless in number, bore names, such as Gabriel, Raphael, Michael and Uriel; and with the growing transcendence of the Deity, the prophets received their messages through "the angel of the Lord." In the apocalyptic literature, as for instance the Book of Enoch, angels intercede with God for the righteous. In the New Testament this function is filled only by Jesus; but its writers evidently share the popular belief, for angels play an important rôle in the nativity and resurrection narratives. Jesus says of them that they are limited in knowledge, do not marry and rejoice over sinners that repent. St. Paul warned against the practice of worshipping angels.

**ANGEL-FISH**, a term applied to several different fish. The *Squatina squatina*, closely allied to the shark, is about 4 ft. long, has a mottled skin and large, wing-like pectoral fins. It is found in warm seas. The *Chaetodipterus faber* is found in the Atlantic from Cape Cod to Rio de Janeiro. It is greenish in color, and the young are banded vertically with black; the body is greatly elevated and compressed. The genus *Pomocanthus* and genus *Holocanthus* are both carnivorous fishes of the tropical seas, noted for their singular form, bright colors and great activity. Each species of angel-fish is of some importance as a food fish. See SPADE-FISH; BUTTERFLY FISH.

**ANGELICA**, the name given to a group of tall perennial herbs of the parsley family. There are up-

wards of 40 species, mostly natives of the northern hemisphere, some 20 growing in the United States. The garden angelica (*Archangelica officinalis*), with stout stems 6 ft. high, spindle-shaped roots and ornamental foliage, is used to some extent medicinally; the candied tender stalks make an aromatic confection. The stems, blanched like celery, were once widely used in northern Europe. In Iceland the plant is commonly cultivated as a vegetable. The great angelica (*A. atropurpurea*), with thick purple stems as tall as a man, found from Newfoundland to Iowa, and the coast angelica (*A. hendersonii*), of the Pacific States, with shorter, stouter stems, are among the best known American species.

**ANGELICA-TREE** (*Aralia spinosa*), a spiny, aromatic shrub of the GINSENG family, called also Hercules' club and devil's walking-stick. It is native to the southeastern United States and is occasionally cultivated. The stout stem divides into club-shaped branches, at the ends of which are crowded very large compound leaves, 2 to 3 ft. long, composed of a great number of leaflets. In midsummer appear the small white flowers which are borne in huge clusters, 3 to 4 ft. long. The similar but more hardy Chinese angelica (*A. chinensis*), very showy when in bloom, is widely planted for ornament.

**ANGELICO, FRA** (1387-1455), Florentine religious painter. Guido da Vecchio, later Fra Giovanni da Fiesole and known from his great piety as "l'Angelico," was born in 1387 near the Castello di Vecchio in Tuscany. At the age of 20 he joined the Dominican Order. He began his artistic career as a miniaturist and illuminator of manuscripts, subsequently working in fresco at Foligno and Cortona. About this time he painted his best known work, the *Madonna of the Flax-Workers*, now in the Florence Academy. The 12 angels, playing various musical instruments and surrounding the central panel of this celebrated work, are familiar from countless reproductions. In 1436 Pope Eugenius IV gave the convent of San Marco at Florence to the Dominicans. They rebuilt it, and Fra Angelico was invited to decorate the new building. These frescoes, his most important works, reveal him as a pioneer of modern ideas. They, and especially the great *Crucifixion*, show how far he had advanced beyond earlier naïvely beautiful figures. His love for nature and the introduction of real landscape into his devotional pictures present him as one of the fathers of landscape painting. He also gave humanity to the hitherto rigidly wooden Madonna and Child, and, a yet more startling innovation, introduced portraiture into strictly religious art, by painting his friends as the saints and martyrs in his works. Vasari says that his fervent piety was such that he never began painting without prayer. His power of religious expression grew with his increasing mastery of technique. Under Pope Eugenius IV he worked in the Vatican, also painting a chapel for Pope Nicholas V. He died at Rome, Mar. 18, 1455. Subsequently the Roman Catholic Church beatified him.

**ANGELL, JAMES BURRILL** (1829-1916), American educator, was born near Scituate, R.I., Jan. 7, 1829. He graduated in 1849 from Brown University, where in 1853 he took the chair of modern languages. From 1860-66 he edited the *Providence Journal* and resigned to become president of the University of Vermont. His progressive educational methods attracted wide attention, and the University of Michigan in 1871 elected him president, a position he held until 1909. Angell served as minister to China from 1880-81 and as minister to Turkey from 1897-98. He died at Ann Arbor, Apr. 1, 1916.

**ANGELL, JAMES ROWLAND** (1869- ), American educator, was born at Burlington, Vt., May 8, 1869, the son of JAMES BURRILL ANGELL. At Chicago University he was a member of the psychology department, 1904-20; senior dean, 1908-20; dean of the university faculties, 1911-20. In 1920-21 he was president of the Carnegie Corporation, New York. Angell became president of Yale University in 1921.

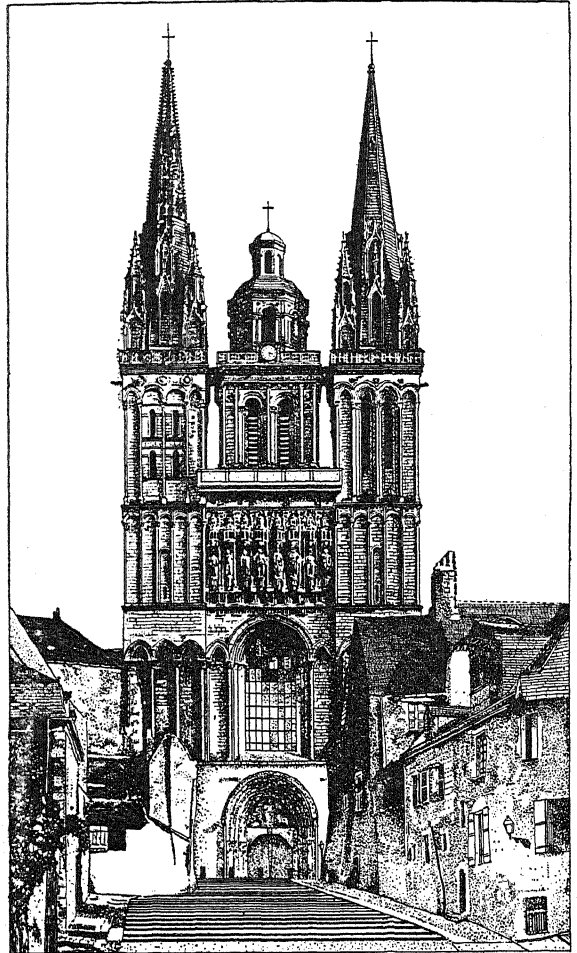
**ANGELUS**, a Catholic devotion, repeated three times a day in honor of the Incarnation. The prayer begins with the words "*Angelus Domini nuntiavit Mariae.*" According to the statutes of Wells Cathedral, 1331, a church bell should be rung at each devotion with three quick strokes, repeated three times. The evening Angelus is the subject of a deservedly popular picture by the French artist Millet.

**ANGERS**, a city of western France, situated on the River Maine 5 mi. above its junction with the Loire. The capital of the present department of Maine-et-Loire, an ancient seat of the Counts of Anjou, Angers is one of the most beautiful towns in France, and of great historical and architectural interest. Its Gothic cathedral is especially famous. The Castle of Angers, built chiefly in the 13th century and partly demolished in the 16th, still keeps imposing feudal walls. There are a number of other fine buildings, and a good museum. The early Plantagenet kings of England, as Counts of Anjou, spent much time here. In recent years many of the old streets have been demolished; but Angers retains picturesque medieval vistas. Slate from nearby mines supplies the largest industry, and surrounding flower nurseries are famous. Pop. 1931, 85,602.

The Cathedral of St. Maurice at Angers, begun in the second half of the 12th century, was completed in the following century. Though its façade is disproportionately narrow, the cathedral as a whole is an imposing Gothic structure, set in a commanding position. The interior has an unusually broad nave, undivided by aisles, and is lighted through splendid medieval glass. The earliest stained glass of Angers dates from 1170, and there are also beautiful windows of the 13th and 15th centuries. The nave has domed vaulting built in the transitional style of the 12th century. The special glory of the cathedral lies in its unrivaled collection of Gothic tapestries, especially the 14th century series of the Apocalypse.

**ANGEVINS, THE, or PLANTAGENETS**, embrace the kings of England from Henry II, 1154, to

Richard III, who died 1485. The name, to some extent a modern usage, since all of these kings did not use it, derives from Geoffrey, Count of Anjou, who is said to have worn, as an emblem, the *planta genesta*. The early Plantagenets form an unbroken dynasty to the death of Richard II, 1399, when the Crown passed to the HOUSE OF LANCASTER, a cadet branch by John of Gaunt, third son of Edward III. These kings were displaced in 1461 by the Yorkists, descended from



CATHEDRAL OF ST. MAURICE, ANGERS  
West side and towers.

the second and fifth sons of Edward III, who, in turn, were displaced in 1485 by Henry VII, a Tudor, a son of the great-great-granddaughter of John of Gaunt and husband of a niece of Richard III. The last direct male descendant of the Plantagenets, Edward, Earl of Warwick, was executed in 1499. An illegitimate line founded by Sir Charles Somerset, son of Henry Beaufort, Duke of Somerset (d. 1464), continued and received the title of Duke of Beaufort in 1682.

**ANGHIERA, PIETRO MARTIRE D'** (1459-1526), Italian geographer and historian, who lived most of his life in France and Italy. He went to

Spain in 1487 and was present at the taking of Granada, his letters being an interesting source of information concerning this event. He knew personally many of the great explorers of his time, among them Columbus, Magellan and Vasco da Gama, and his writings abound in stories which they told him. In 1520 he became royal chronicler, and later was appointed a member of the Council of the Indies. His principal works are *De Rebus oceanicis et Novo Orbe Decades*, a history of the New World and the *Opus Epistolarum*, some 816 letters of great historical value, treating contemporary events.

**ANGINA PECTORIS**, a condition characterized by attacks of extreme pain over the heart, often commonly called "neuralgia of the heart." The pain is noticed on effort, such as walking, especially walking up an incline, against a cold head wind, or after a heavy meal. Occasionally a fit of anger brings on the attack. When the patient slows up or stands still for a few minutes the suffering is over. The pain varies in severity, from an uncomfortable sensation of burning or pressure to a most agonizing feeling of constriction in the center of the chest in front. The pain radiates to the neck or arms, especially the left arm. It may run down the inner side of the arm as far as to the fingers. Men are much oftener affected than women. It is rare before the age of forty-five. A tendency to this condition may run in a family along with high blood pressure, apoplexies and other diseases of the blood vessels.

The cause is believed to be a hardening of the coronary arteries which nourish the heart muscle. The thickening of the walls of these arteries narrows the caliber of the vessels and thus interferes with the blood supply. When the heart muscle calls for more blood as on rapid walking, the demand cannot be met and a painful seizure is the result. A spasm of the vessel may explain some attacks that are seen in individuals with normal coronary arteries.

The condition is a serious one. The dread of the disease is unfortunately well grounded; in fact, sudden death may occur. A clot may form in the diseased coronary artery causing an attack of unusual severity and duration; this may be fatal. However, much can be done to alleviate suffering and life may be prolonged for years. Cures are occasionally reported.

Drugs and other remedies prescribed by the physician may materially improve conditions, so that the patient is not only able to live in comparative comfort for years but to continue at his work. Of great importance is the regulation of the mode of living. The patient must walk more slowly, eat simple food, have small meals, use less tobacco and alcohol, have shorter hours of work, longer hours of sleep and rest, less worry and responsibility. The advice of the physician to avoid the strenuous life, to take it easy, is worth fully as much as the drugs he prescribes.

Recently, division of certain sympathetic nerves has been advocated. This treatment is advisable rarely.

There is a group of symptoms which, because of pain in the region of the heart, though the heart

itself is not diseased, is sometimes called *pseudo-angina* or false angina. It is met with especially in those who are nervous and worried, or are for some reason run down. It is seen in those who have a fear of heart disease. It is not real angina pectoris, and the symptoms disappear when the patient is assured that the heart and its blood vessels are healthy, and when the underlying conditions of fatigue, anemia, etc., are relieved.

It is to be remembered also that there are many other causes for pain in the region of the heart, as pleurisy, pneumonia, inflammation in the bones of the chest or in the joints of the spinal column, certain diseases of the stomach, liver and gall-bladder. The physician should, therefore, be consulted so that the nature of the trouble may be known. J. B. HE.

**ANGIONEUROTIC EDEMA.** See EDEMA.

**ANGIOSPERMS**, a group name for plants the ovule of which is borne in a closed ovary, which ultimately ripens into a fruit. The angiosperms comprise 95% of all living flowering plants. They became dominant over the remaining 5%, the gymnosperms, towards the end of the Eocene period. Compared to the naked ovules and wind pollination of most gymnosperms, the origin of the angiosperms was a great step in advance. The protection afforded by the closed ovary and the almost overwhelming insect pollination which characterizes the angiosperms have resulted in the development of over 300 families of angiospermous plants. See MONOCOTYLEDONS; DICOTYLEDONS. N. T.

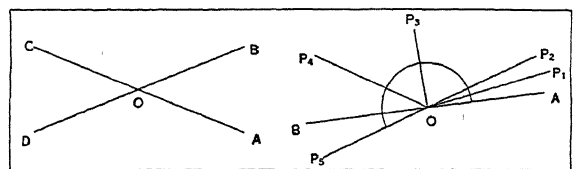
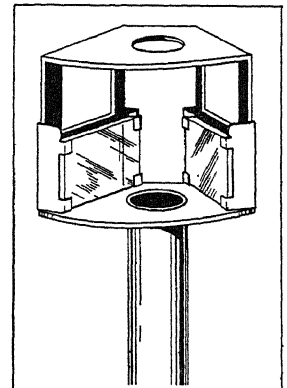


FIG. 1

**ANGLE.** A *plane angle* is a geometric figure formed by two intersecting lines (Fig. 1), or by a rotating line pivoted on another line (Fig. 2). In Fig. 1, the smaller angle is considered unless the contrary is stated. In Fig. 2, the rotating line *OP* generates angles of any size, one revolution giving an angle of  $360^\circ$ , and so on. In Fig. 1, *O* is the vertex of  $\angle ROB$ , and *OA* and *OB* are the *arms* or *sides*.

A *spherical angle* is similarly formed on the surface of a sphere, geodesic lines, or arcs of great circles, replacing straight lines. A *dihedral angle* is formed by two intersecting planes, and a *polyhedral angle* by three planes intersecting in a point, the vertex.

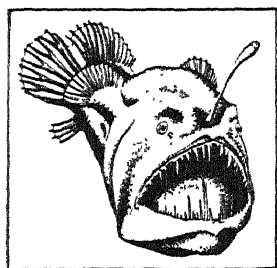


ANGLE MIRROR



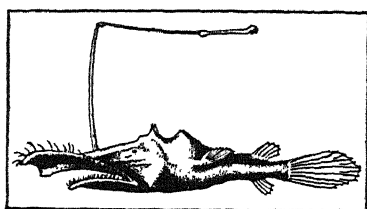
**ANGLE MIRROR**, an optical instrument having two mirrors permanently fixed, say at an angle of  $45^\circ$ . It generally measures only angles of  $90^\circ$ , but in a few instruments the mirrors are fixed at an angle of  $30^\circ$  so as to measure angles of  $60^\circ$ . If the mirrors are replaced by a reflecting prism, the instrument is called an angle prism. With an angle mirror, measuring tape, and a few poles, which may be cut in the field, sufficient data may be obtained to map any limited territory, such as a small island or lake, and to find the area inclosed.

**ANGLER** (*Lophius piscatorius*), an exceedingly ugly marine fish of the order *Pediculati*, abundant



ANGLER FISH (*Lasiognathus melanocetus johnsoni*)

around the coasts of Europe and on American shores from Nova Scotia to the Barbados. It is a mottled brown in color, and has a large, flattened head and enormous mouth with strong, backwardly-directed teeth. The first spine of the dorsal fin is a long filament on the head; brightly-colored and freely movable; it acts as allure for other fish. The maximum length of the angler is 5 ft. Its eggs are embedded in a gelatinous, transparent, pinkish sheet, 30 to 40 ft. long, and from 1 to 3 ft. wide. They float near the surface in summer.



ANGLER FISH (*Lasiognathus saccostoma*)

**ANGLESEY** or **ANGLESEA**, an island and county off the northwest coast of Wales united to the mainland by two bridges. Ninety percent of the land is used for cattle and sheep grazing; trees only grow at the county seat, Beaumaris, and on the channel land. In the center is a row of hills with copper mines. In ancient times Mona, in medieval times Anglorum insula, Anglesey was occupied in 61 A.D. by Suetonius Paulinus, who destroyed the holy groves of the Druids. In the 9th century the Saxon Egbert took the island, but it was soon recovered by the Prince of North Wales. Pop. 1931, 49,025.

**ANGLESITE**, a minor ORE of lead which not infrequently carries silver. A sulphate of lead, it usually occurs as an alteration product of GALENA, lead sulphide. The color is white, sometimes tinged yellow, gray, green or blue, varying from opaque to trans-

parent. Anglesite crystallizes in the ORTHORHOMBIC SYSTEM.

At Tintic, Utah, and Broken Hill, New South Wales, abundant anglesite has been found. It occurs near the surface in most galena deposits. The name is derived from Anglesea, where it was first found in England. See also ORE DEPOSITS.

**ANGLICAN CHURCH.** See CHURCH OF ENGLAND; PROTESTANT EPISCOPAL CHURCH IN THE UNITED STATES.

**ANGLING**, fishing with rod and line. There are thousands of methods for angling for fresh- and salt-water game fish varying according to the individual's opinion and the locality being fished. It is best for anyone seeking any particular species to gather as much information before the start of the trip as possible, and then a little more from the natives upon arrival at the destination. The most important game fish, their habitats, and the baits with which they are lured follow:

**Brook trout**, brown and rainbow. These fish are caught throughout the northern part of the United States and all of Canada, but seldom taken in the South. They are found in cold spring or snow-fed streams, rivers, lakes and ponds, and are lured to strike with worms, minnows, grasshoppers, bees, caterpillars, butterflies, artificial flies and spinners.

**Black bass**, large and small mouth. The small mouth bass is gamier than the large bass and is found in ponds, lakes and rivers where the water is cold. He is a great fighter, jumping repeatedly from the water. He is lured to strike with frogs, minnows, hellgramites, worms and many artificial lures such as plugs and flies. The large mouth variety is usually found in warm sluggish ponds and lakes. They grow unusually large in the South, especially in Florida, where some have been taken weighing from 20 to 30 pounds.

**Pickarel, pike and muskellunge.** They are found in the northern part of the United States and in Canada, in streams, lakes and ponds. Rarely are pickarel over 7 pounds taken, though pike run to 30 and muskies as high as 60 pounds. They are lured with minnows, plugs and spoons.

**Flounders and fluke.** These fish are caught on the east coast from Maine to Virginia. Flounders are usually found in bays and inlets where the sand or mud is unpolluted. The fluke is larger in size and is found in the ocean, inlets and bays, always on the bottom. A light rod is used for the capture of both, the tip of the rod weighing from 2 to 4 ounces. The best baits for flounders are bloodworms, sandworms and clams; for fluke, killies, spearing and strips of flesh cut from other fish or from the fluke itself. Flounders weigh from  $\frac{1}{2}$  to 4 pounds each, and fluke run anywhere from 1 to 15 pounds.

**Striped bass, seabass and porgies.** The striped bass is a greatly sought after game fish among anglers. It ranges from Maine to the Carolinas and is also taken in California salt waters. A rod weighing from 3 to 10 ounces should be used, depending on the size

of the fish being sought. The best baits are crabs, clams, worms, eels, mullet and cut-up fish. Bass will also strike a lead squid or spoon. They weigh from 1 to 73 pounds, the latter weight being the world's record in angling. Seabass are caught from Long Island to the Carolinas. They look somewhat like a fresh-water bass and usually are found in large schools making their habitat around rocks and wrecks. They feed on sea clams, squid or inkfish, and mossbunkers. Seabass weigh from  $\frac{1}{2}$  to 7 pounds and are much sought after by the anglers of New York and New Jersey. Porgies come in with the seabass and are caught with the same baits. They are frequently plentiful and range in weight from  $\frac{1}{2}$  to 4 pounds.

**Cod, pollock, hake and ling.** These winter species are caught along the Atlantic coast from Newfoundland to Virginia, and also on the west coast. They feed on clams, conchs and scallop guts. Cut fish bait also can be used as a lure. These fish are usually angled for in the spring and winter. Cod caught by angling weigh from 3 to 60 pounds. These four winter species travel together and are often caught on the same spot on the same day.

**Bluefish and weakfish.** These fish are caught from Massachusetts to Florida. They are game, hard fighters, the bluefish being the harder battler. Bluefish can be caught by trolling with lead and cedar squids; also by still fishing, chumming with mossbunker, and using bunker for bait. Weakfish are usually caught still fishing, chumming with either shrimp or mossbunker and using as a lure, large sandworms, bloodworms, crab, squid or shrimp. Bluefish run to 15 pounds, and weakfish to 16 pounds.

**Channel bass and drum.** These fish are caught from New Jersey to Florida. They usually feed close to shore in the surf, inlets and bays, and are lured by menhaden, crabs, mullet and squid. Channel bass are distinguishable from the drum by a black spot down near the tail and are far gamier. They range in weight from 5 to 75 pounds. Drum fish are often caught weighing from 70 to 85 pounds.

**Tuna, albacore and bonita.** These fish, caught on both the East and West coasts, are speedy swimmers, hard fighters and delectable food fish. They are usually caught while trolling from a boat going 6 to 8 miles an hour, with lead squids, spoons, or a large bunch of white feathers. Bonita usually weigh around 6 pounds; albacore 20, and tuna 5 to 700 pounds.

**Broadbill and marlin swordfish.** These fish are fairly plentiful in the vicinity of Montauk, L.I., and Block Island, R.I. The marlin is also captured in the Gulf Stream off Florida. Both species are taken on the West coast in the vicinity of Catalina Islands, Cal. One needs an experienced guide for this type of angling, who can usually furnish the necessary outfits and explain how it is done. Marlin have been caught by angling, weighing up to 976 pounds, and broadbills as high as 576 pounds.

**Tarpon.** The tarpon is caught on the east and west coasts of Florida, the Gulf of Mexico and off

Panama. One requires an experienced guide for tarpon also, who generally has outfits as in swordfishing. Tarpon range from 10 to 200 pounds.

**Sailfish.** The sailfish is the most sought after species by winter visitors to Florida. It is a great jumper and gives perhaps the best fight of all due to the fact that one can employ light tackle when angling for this species. A boat and guide are essential for their capture. They are taken in the Gulf Stream, the best spots being along the edge of the gulf. They range in weight from 30 to 100 pounds. The new world's record, recently established off the west coast of Panama, weighed 180 pounds and measured almost 11 feet in length. F. F.

**ANGLO-EGYPTIAN SUDAN.** See **SUDAN.**

**ANGLO-ISRAELISM,** a theory that combines certain mystical and millennial ideas and the identification of the Anglo-Saxon race with the Lost Ten Tribes. The movement which is fairly widespread both in England and in the United States has established no church; nor does it indulge in a special communion. The theory originated with Richard Brothers (1757-1824), who advanced the claim that the Saxons were members of the Lost Ten Tribes, and his work "Correct Account of the Invasion of England by the Saxons showing the English Nation to be descended from the Lost Ten Tribes," 1822, is the basic work out of which a considerable literature has been evolved. By the extreme literal acceptance of the King James, and now the Revised Version of the Old Testament, Anglo-Israelites find support for their idea that they are of Israel, not of Judah. Along philological lines it is thus found that Britain, or Britland as Anglo-Israelites prefer to designate it, is a compound of the Hebrew *berit* and the Saxon *land* and is equivalent to "Land of the Covenant." British is thus two Hebrew words *berit* and *Ish* "Man of the Covenant." Prophetic and apocalyptic texts are employed to develop the idea. Accordingly "assembly of the peoples" identifies the Anglo-Saxon element in the United States, while "company of nations" bespeaks the British Empire, all descended from "the beautiful Joseph and the Egyptian Princess Asenarth." Theories relating to Egyptian weights and measures, and the mathematics of the Great Pyramid are quoted by some in support of the idea, while almost all followers regard the Scone Stone on which British kings are crowned in Westminster Abbey as the stone on which Jacob dreamed his vision of the ladder reaching to Heaven, and add that Queen Victoria claimed Davidic descent.

A third element employed in favor of the theory is the transmutation of the letters of the alphabet, on lines similar to those employed in Hebrew counting, into numerals. These by permutations offer all sorts of equivalents that bear on prophetic texts or establish detailed identifications. The millennial phase is the belief that "the promise of the heirship of the world" is to be realized by the Anglo-Saxon peoples who for this purpose include the Scots, Irish, Welsh, Picts, Danes, Engols, Saxons and Jutes commingled

with the Normans. The mysticism relates mostly to the time and dates in Daniel and Acts. Thus Anglo-Israelites figure that Judah was overthrown in 623 B.C., and "reckoning seven times in solar years from this epoch brings to 1898 A.D." when the "new era" was to begin. The Spanish War and the attitude of the British Government towards the American military enterprise were regarded as evidence of the beginning of the "new era."

The movement has a considerable literature, particularly in the form of pamphlets published in many places on both sides of the Atlantic. J. DE H.

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**ANGLO-JAPANESE ALLIANCE, THE**, an agreement between Great Britain and Japan first signed on Jan. 30, 1902, whereby each nation agreed to come to the other's support in case either became involved in war and a third nation entered the conflict against the ally involved. The alliance was sought by Japan in order to secure protection against Russian advances into Manchuria and Korea, and was agreed to by Great Britain as a means of helping to protect the British interests in North China and in India. The alliance provided for the preservation of the independence and the territorial integrity of China and Korea. On Aug. 12, 1905, a revised alliance was signed. By this, the paramount interests of Japan in Korea were recognized. Otherwise it was along the same general lines as the 1902 alliance. The existence of the 1902 alliance was one of the principal reasons why France would not join Russia in the Russo-Japanese War of 1904-05. The alliance was renewed on July 13, 1911, and Japan came into the World War on the side of the Allies as a result of this 1911 alliance. The existence of this agreement between Japan and Great Britain created growing ill feeling in China as well as in the United States, and considerable uneasiness in Japan itself. The alliance therefore was cancelled by mutual agreement at the time of the Washington Conference, 1921-22.

**ANGLO-SAXON LAW**, broadly speaking, the legal rules and customs followed in England prior to the Norman invasion. The customs came mainly from lower Germany and Scandinavia. The Roman Law had little influence except in ecclesiastical matters, and even in those there was not strict adherence, because of England's isolated location. Wessex, being the dominant English state, the residence of the Court, and the literary center, furnished the dialect used by the scribes. Kentish and Northumbrian words occur occasionally; Danish words appear only in technical terms.

**ANGLO-SAXON LITERATURE**. See **ENGLISH LITERATURE**.

**ANGLO-SAXONS**, the name for the people of Britain who descended from the Angles, Saxons and Jutes, German tribes which came to the island in the 5th and 6th centuries A.D. The Jutes arrived first, and

were followed by the Angles and Saxons, who formed their individual kingdoms, finally to be united in the 9th century.

**ANGOLA**, Portuguese West Africa, a Portuguese colony on the west coast of Africa, bounded on the west by the Atlantic Ocean, on the north and east by the Belgian Congo and on the south and east by the Union of South Africa and Rhodesia. Area 486,071 sq. mi. Pop. 1926, 2,481,956. There are about 40,000 Europeans; the natives are Bantu Negroes. The territory consists of a coastal plain and a strip of upland, both narrowing towards the south, and behind these the Bihé plateau draining north into the Congo and south into the Zambesi.

The town of SÃO PAULO DE LOANDA, frequently shortened to Loanda, stands on a small island, has a fairly good harbor, soap and tobacco factories, and a railway line running eastward to Melanje. Lobito has a natural deep-water harbor, and a railroad open as far as the Belgian Congo frontier. When completed this is expected to serve a great mineral district and open up a large agricultural area. Mossamades is a center for irrigation, and has a fish-curing industry. Benguela is an old port. In 1928 the capital was removed from Loanda to Nova Lisboa, a healthier spot a mile above sea level and 225 mi. inland on the railroad.

Temperatures are tropical but somewhat modified where the cool current flows along the coast. The rainfall, very low on the southwest coast, occurs chiefly in summer, so that savanna vegetation prevails. Agricultural development has taken place in recent years. Activities have been centered in the growing of maize by an increasing number of white farmers. Cattle-raising on the plateau, coffee plantations in the Cazengo district 200 mi. east of Loanda, tobacco culture, and, largely with the aid of irrigation, sugar and cotton cultivation, have received considerable attention. Deposits of copper, iron, malachite and gold are known and salt is obtained from coastal lagoons. Diamonds are found in the north-eastern part of the colony which produced 180,334 carats in 1927, but only a small proportion of the stones obtained have exceeded one carat.

The territory is governed by a high commissioner. Portugal has owned it since 1575, except for the years 1641 to 1648, when it was held by the Dutch.

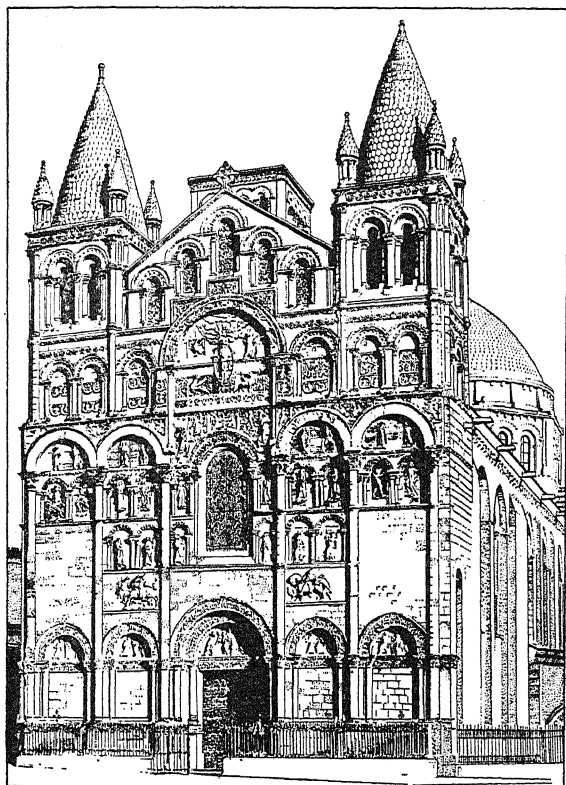
**ANGOLA**, a city in northeastern Indiana, the county seat of Steuben Co. It is situated 42 mi. northeast of Fort Wayne and is served by the New York Central Railroad. Grain is the chief crop of the region and sheep-raising is an important occupation. The principal local industry is food packing, principally canned goods. Angola is a summer resort in the lake region and is near Pokagon State Park. It is the seat of Tri-State College. The city was founded in 1834; incorporated in 1906. Pop. 1930, 2,650; 1930, 2,665.

**ANGORA**. See **ANKARA**.

**ANGOULÊME**, a town in west central France, built on a hill 235 ft. above the Charente valley, and

capital of the Charente department. Francis I was Count of Angoulême, and his sister Marguerite de Navarre, author of the *Heptameron*, was born here in 1492. The chief manufacture is fine paper. Pop. 1931, 36,699.

The Cathedral of St. Pierre at Angoulême, one of the most interesting Romanesque-Byzantine churches of the south of France, was begun in the 11th century and largely rebuilt in the 12th. Damaged during



WEST FRONT OF CATHEDRAL OF ST. PIERRE, ANGOULÊME

the wars of religion, it was repaired in the 17th century, and restored by Abadie in 1866-75. The rich sculpture of the west front is especially noteworthy, and the carving throughout the church is of marked elegance. The high square tower of the north transept is the most beautiful external feature of the church. Covered by three great domes, the nave is among the largest in southwestern France.

**ANGRA.** See AZORES.

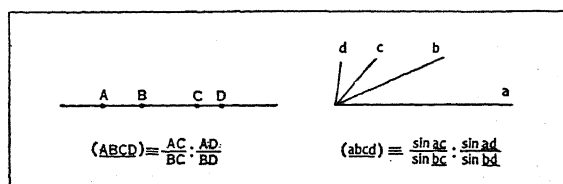
**ÅNGSTRÖM, ANDERS JONAS** (1814-74), Swedish physicist, was born at Medelpad, Sweden, Aug. 13, 1814. In 1839 he became instructor and in 1858 professor of physics at the University of Upsala. His studies in spectroscopy, published in 1853, brought him recognition as a pioneer in that field. Eight years later Ångström began a series of studies of the solar spectrum, culminating the next year in experiments by means of which he determined the presence of hydrogen in the solar atmosphere. In 1868 he devised a chart revealing the relative wave-

lengths in the normal solar spectrum. His researches included the first inquiry into the spectrum of the aurora borealis. He died at Upsala, June 21, 1874.

**ÅNGSTRÖM UNIT**, a unit of length equal to one-ten-millionth of a millimeter, commonly used in connection with sub-microscopic magnitudes, especially in the measurement of wave lengths of light; it is sometimes called a tenth-meter because it is one meter divided by ten to the tenth power. It was first used in 1868 to specify wave lengths of light by ÅNGSTRÖM of the University of Upsala, Sweden.

**ANHALT**, a free state of Germany. It consists of two main parts: a larger eastern section in the valley of the Elbe River, surrounded by the Prussian province of Saxony, with level, fertile soil; a western section bounded by the Prussian province of Saxony and part of Brunswick and belonging to the Hartz Mountains. With an area of 888 sq. mi., it is the twelfth largest state in Germany. Of the total population, 351,045 in 1925, 320,850 were Protestants; 14,327, Catholics, and 1,140, Jews. Of the 164,184 earning population 18.5% are engaged in agriculture and forestry, and 47.7% in industry, mining and trades. Large quantities of sugar-beets are grown for the many sugar factories and there is a considerable number of large estates. There are deposits of brown-coal, mineral coal and potash salts. The capital is DESSAU, pop. 1925, 71,272.

**ANHARMONIC RATIO**, a ratio which plays a very important part in PROJECTIVE GEOMETRY. To take two of the simplest cases, the anharmonic ratios of four points on a straight line and of four line segments proceeding from a point are defined by the following figures and symbols:



From each of these, by permuting the letters, other anharmonic ratios can be formed. We may also have anharmonic ratios of planes. Anharmonic ratios are also called cross ratios or double ratios. For a treatment of the subject consult any work on projective geometry.

**ANHINGA**, the name applied to the American representative of a small group of very slender long-necked water birds allied to the cormorant, snake bird, darter, or water turkey. Like cormorants they have all four toes joined by webs but the bill instead of being hooked is slender, sharply pointed and provided with backward-pointing projections so that the anhinga transfixes its prey. There are four species, the American (*Anhinga anhinga*) in Florida and the Gulf States and north to the Carolinas and Illinois; the African (*A. leucorhynchos*), in Syria, northern Africa and Madagascar; the black-bellied (*A. melanogaster*), from Mesopotamia to the Philippines; and the south-

ern (*.1. novae-hollandiae*), from New Guinea to New Zealand. All are dark, glossy birds, energetic fishers, perfect divers and have a labored but powerful soaring flight. The American snake bird is about 36 in. long. C. J.

**ANHYDRIDE**, a term meaning waterless, applied to an oxide (*see* OXIDES) capable of forming an acid when united with water or of forming salts when combined with a basic oxide. Such oxides are commonly called the anhydrides of their respective acids. Phosphorus pentoxide unites with water to give phosphoric acid; sulphur trioxide combines with water to form sulphuric acid. These oxides, therefore, are the anhydrides of phosphoric and sulphuric acid respectively. Also, chromic oxide, which combines with barium oxide to produce barium chromate, is classified as an anhydride.

**ANICETUS, ST.**, bishop of Rome from about 157 to 168. It was during his papacy that Polycarp visited Rome in regard to the dispute over the date of Easter. Anicetus is considered a martyr by the Roman Catholic Church and his anniversary is celebrated on Apr. 17.

**ANILINE**, one of the basic organic AROMATIC COMPOUNDS (formula,  $C_6H_5NH_2$ ) which forms salts, such as aniline hydrochloride, with the mineral acids. It is a liquid of characteristic odor; melting point  $-6^\circ C$ ; boiling point  $184^\circ C$ . It is poisonous when it gets into the blood stream by absorption from the alimentary system, lungs or skin. It is somewhat soluble in water and is miscible in all proportions with the usual organic solvents, as alcohol, ether and benzene. It forms derivatives by replacing the nuclear hydrogen atoms with other groups, as p-nitraniline. Other derivatives are formed by replacing amino-H atoms with other groups, as acetanilide or dimethyl aniline. The amino-group may also react with nitrous acid to form DIAZO-COMPOUNDS.

Aniline is manufactured by the reduction of NITROBENZENE and by the ammonolysis of chlorobenzene. The reduction of nitrobenzene is generally carried out by heating nitrobenzene with water and iron filings and a small amount of hydrochloric acid, the aniline being removed by steam distillation. Another method of reduction is catalytic reduction by means of  $H_2$  over a nickel catalyst in the gaseous phase. The second method of manufacture is carried out by heating chlorobenzene with aqueous ammonia in the presence of  $Cu_2O$  as catalyst at  $200^\circ-230^\circ C$ . under pressure in liquid phase. The aniline is removed by separation, as an oil, from the aqueous layer.

Aniline is used in the manufacture of a large variety of azo-dyes (*see* DYES, SYNTHETIC), vat dyes, synthetic resins, rubber chemicals, intermediates for dyes, and synthetic drugs. E. C. Br.

**ANIMAL**, a word originally used to denote a living thing (Lat. *animalis*, from *anima*, breath, soul), but now restricted to mean all organisms in the animal kingdom as opposed to plants which constitute the other kingdom of living forms. The term is sometimes incorrectly applied only to the furred animals or

mammals, but should properly include all living organisms which are not plants.

It is not possible rigidly to separate plants from animals by means of definite characteristics which are always found in one group as contrasted to the other. On the whole, however, it may be stated that (1) animals have pliable cell walls which allow relatively great motility and (2) animals lack the power of photosynthesis and are dependent upon organic compounds for food.

It is true that certain plants, such as the fungi, are dependent upon synthesized organic food, but in these cases the plants normally have rigid cell walls composed largely of cellulose, and their body structure and reproductive system indicate that they have descended from green plants. There are a few cases, such as the Tunicates, among animals in which cellulose is secreted, but the relationship of these animals to other animals is quite obvious through their structure and development.

Some living forms, such as the Flagellates, do not possess cellulose cell walls and are consequently as mobile as most animals, and at the same time do possess chlorophyll and are capable of carrying on photosynthesis. It is the opinion of many biologists that these organisms are neither plants nor animals in the strict sense, but are probably similar to the ancestral type from which both the higher plants and animals have evolved.

In spite of these exceptions, it is possible to classify the vast majority of organisms into either the plant or animal kingdom without difficulty; for most animals move freely about, and require organic foods. *See* ZOOLOGY. A. E. Em.

**ANIMAL FATS**, the unctuous or greasy matter consisting of, or obtained chiefly from, the adipose tissues of animals. Chemically, fats are a combination principally of carbon, hydrogen, and oxygen, with carbon and hydrogen predominating. These elements are responsible for the familiar heat-producing properties of fat when burned or taken as food. In most animal fats the elements are in a relatively unstable combination, as a result of which oxidation, or spoilage, takes place, especially in the presence of a warm atmosphere and light.

The physical characteristics of fat vary with the food eaten by the animal, the kind and age of the animal, and the portion of the body in which the fat is deposited. Commercially, fats are grouped also as edible and inedible. The former includes such fats as lard, oleo stock, and mutton tallow obtained from the sound tissues of healthy animals. Inedible fats, many of which are marketed as greases, soaps and candles are obtained from tissues having inferior flavors or odors, or that have undergone partial spoilage.

The processing of animal fats is conducted mainly as a branch of the meat-packing industry. Though varying somewhat according to the product desired, typical procedure consists in melting or rendering, clarifying, and further purification, sometimes in-

volving the use of decoloring agents. Control of temperatures throughout the process is highly important. Fats appear on the market in a wide range of packages, from small paper cartons to barrels. See also ANIMAL OILS; OILS. D. S. B.

**ANIMAL INDUSTRY** is the comprehensive term under which are grouped all the animals bred and reared by man for use or pleasure, as well as their care and health and disease, their products, their carcasses and by-products and the legislation enacted to cover all phases of the general subject. The extent and importance of animal industry is best suggested by the list of animals used for one or more purposes: namely, horse, ox, camel, ass, elephant, ostrich, reindeer, llama, dog, sheep, goat, hog, hare, rabbit, poultry, fish, shellfish, turtle, frog, bee, silkworm, fur-bearing animals, cat, ferret, sponge and cage-birds.

Animals have been reared chiefly for power or food or both. Although in civilized countries motors have largely replaced them, in the former rôle they are still extensively used. Practically every farm keeps animals of some kind and nearly every home has one or more pets. Through breeding and selection marvelous improvements have been made as evidenced by speed of race horses, power of draft animals, quantity and quality of milk, wool and meat, fecundity of poultry and fish, honey-producing capacity of bees, and the development of distinct breeds, varieties and strains in many species.

Breeding, however, means not merely increase in numbers but improvement of the animals produced over their predecessors, thus enhancing their value to man. Hand in hand with breeding goes feeding. This is no longer the hit-or-miss practice of the past, but a broad and exceedingly complex subject based upon the findings of chemistry and physiology and formulated as the laws of nutrition. As the life processes are hidden, investigators must make deductions largely from results beyond the scope of superficial observation and empirical practice. On their findings modern feeding and sanitation have resulted in better health and greater profits to animal producers. When feeding and sanitation are disregarded, disease is provided with favorable conditions and the veterinarian is needed. He is also needed in cases of epidemics and contagious diseases, some of which demand drastic measures, such as the destruction of affected animals, as in foot-and-mouth disease and tuberculosis.

Milk, the most important of animal products, is one of the fundamental foods of modern civilization. It reaches market fresh or evaporated and, when manufactured, as butter, cheese, powder, ice-cream and milk-sugar. State inspection so governs its production and handling that its cleanliness is safeguarded at every point from the animal to the home. Since the introduction of the Babcock test for butter fat, dairymen who supply butter and cheese factories have been able to determine which cows were profitable and to use these for breeding still more profitable animals.

Meat production is as rigorously guarded as milk production. Animals are passed upon or condemned by government inspectors so that the public is protected from the farm to the local meat market. Similar considerations apply more or less to the breeding, rearing and uses of all other animals. M. G. K.

**ANIMAL MAGNETISM**, a theory made current by Mesmer, 1734-1815, who revived the ancient belief that magnets had a curative action and announced that a similar force pervaded animal life. He devised a *baquet* or large tub from which projected iron rods for the patients to grasp as they received treatment, the whole suggesting a battery. Later he dispensed with this and announced that magnetism flowed through his person; that he could magnetize a glass of water which his patients would drink and be healed. He even magnetized a tree which would then convey the influence through cords attached to its branches to the patients beneath the tree. He claimed that a sensitive would detect which tree had been magnetized.

Mesmer's method was to induce a crisis and then allay it. Commissions were appointed to examine these claims and they reported that the effects were due to imagination, or to what is now recognized as suggestion. Mesmer's methods and pretensions were those of a charlatan, and the manifestations of his patients were largely hysterical; but the movement gave rise to studies of abnormal mental states, later called Hypnosis. See also HYPNOTISM; SOMNAMBULISM. J. J.

**ANIMAL OILS**, a term applied to liquid fats obtained from animals in contradistinction to those derived from vegetables and mineral sources. Both animal and vegetable oils are composed chiefly (over 90%) of GLYCERIDES, but the various kinds differ in the fatty acids which they contain and by the different arrangement of the acids in simple and mixed glycerides. Most of the oils occurring in animals are taken into the body ready formed in food, but some are manufactured in the system from carbohydrates. The chief animal oils include: fish oils, obtained from menhaden, herring, salmon and sturgeon, used in leather currying and soap making; liver oils, from cod, tunny, Arctic shark, hake and ray, used in medicine and in leather currying; blubber oils, from the whale, seal and porpoise, used for burning and lubrication; terrestrial animal oils, including sheep's, horses' and neat's-foot oils. The oils are separated from the animal tissue by open-kettle, acid, or steam rendering.

**ANIMAL TRAPPING**, snaring or catching animals by mechanical means. Primitive man may have devised a trap, the open pit, before he invented weapons. Certainly all known savage tribes have had some effective method of trapping animals. The oldest is the open pit, with or without a stake on which the animal falls. Such pits are still used by various African tribes. The inclosing pen trap catches elephants in India and Burma, the animals being driven into wings which narrow into a strong enclosure. In the deadfall, still used by North American Indians,



touching a bait releases a catch and drops a weighted log on the animal's back. These traps are both merciful and efficient; the animal is instantly killed, and the fur is not injured. Another ancient trap is the snare. Snares are simple loops set in the runway used by the animal; in passing through a loop the animal is caught by the tightened noose.

The modern steel trap, which dates from the 18th century, has two jaws, actuated by a strong spring. They range from those used for small fur-bearers up to bear traps weighing 50 pounds and having 18-inch jaws. All are attached by a chain to a drag. Large prizes have been offered for a practical trap which will kill the animal when it is captured. Too often animals caught by one leg will chew off the limb and escape maimed, or suffer for days when the trap is not visited.

Most trapping to-day is done in Siberia, Alaska, Canada and the northern United States. Two men usually work together and set a line of traps along streams, valleys and other favorable localities. Making their headquarters at a central camp, they spend the fall and winter visiting, emptying and rebaiting their traps, coming out in the spring with their season's catch. While there are few fur-bearing animals in the South, enormous numbers of muskrats are taken in Maryland and Louisiana each year, Louisiana leading the country in actual number.

**ANIONS**, the name given to the negative ions of **ELECTROLYTES**. During electrolysis, negative ions naturally move toward the positive electrode or **ANODE** (hence the name). Thus, in the electrolytic decomposition of water, the negative hydroxyl ions travel to the anode where they are neutralized and oxygen is liberated. See also **ELECTROLYSIS**.

**ANISE** (*Pimpinella anisum*), as annual plant of the parsley family cultivated in Europe, especially in Germany, in South America and in India for its sweet aromatic seeds which yield a highly perfumed oil. The somewhat branched stem, about 2 ft. high, bears large loose clusters of yellowish flowers. Aniseed is widely used as a condiment and also in medicine.

**ANISE-TREE** (*Illicium floridanum*), a handsome evergreen shrub of the magnolia family, native to sandy swamps in southeastern United States. It grows about 8 ft. high, with anise-scented foliage and small, drooping purple flowers.

**ANJOU, HOUSE OF.** See **ANGEVINS, THE**.

**ANKARA (ANGORA, ENGURI).** 1. The present capital of the Turkish Republic, on the site of the ancient city of Ancyra. It is built on a steep, rocky hill surrounded by an extensive plain in Asia Minor, some 220 mi. east of Constantinople. Fable has it that the city was built by King Midas. It was the capital of the Gallic Tectosages who settled in the region about 277 B.C. After the Roman Conquest, the city became the capital of the Roman province of Galatia Prima (25 B.C.), and there are numerous architectural remains from the Graeco-Roman and Byzantine periods. During the following centuries,

Ankara was captured, in turn, by the Persians, Arabs, Seljuk Turks, Latin Crusaders and Ottoman Turks. The latter acquired the city in 1360, lost it again to Tamerlane in 1402 and recaptured it in 1415. Except for a brief period in 1832 when Ibrahim Pasha and his Egyptians took it, the Turks have held it ever since.

On the eve of the World War, the city had an estimated population of 30,000. After the War, its importance increased rapidly. In Apr., 1920, a national assembly was held there, called together by **MUSTAPHA KEMAL PASHA** and the Turkish Nationalists. Ankara was chosen as the meeting place for this gathering, since it was conveniently far from Constantinople, where Greek soldiers and Allied warships held sway, and since it was a railhead of the Anatolian Railway and could easily feed itself from the surrounding plain. On Oct. 13, 1923, it was designated as the capital of the new Turkish Republic, and from then on special efforts were made by the government to convert it into a great city. The railway communications were improved, streets straightened, new buildings and government offices erected, a telephone system introduced and sanitation, police and fire precautions set up. By the time of the census of 1927, the population had increased to almost 108,000. Ankara became the official name of the city on Jan. 1, 1931.

2. Ankara is also the name of a Turkish vilayet comprising most of ancient Galatia in north central Asia Minor, and including the city of the same name. The inhabitants, who numbered almost 405,000 in 1927, live mainly by agriculture and wool-raising. The leading products are grain, fruits, honey, wood and mohair derived from the hair of the famous Angora goats. W. C. L.

**ANKLE**, a hinge-joint between the shin-bone or tibia and fibula of the leg, above, and the astragalus or mortise-bone of the foot, below. The grooved articulating surfaces are completely encased in a capsule. This is reinforced on all sides by ligaments, the most important of which are those along the inner and outer borders. Many tendons come into close relation with the joint, especially the heel tendon, or tendon of Achilles.

Practically all the motion in the ankle-joint is in the plane of the long axis of the foot. Side motion occurs in a joint in the bones of the foot itself. Locomotion is quite possible with only a comparatively few degrees of movement.

Disturbances of the ankle include chiefly: infections, injuries, and static or postural defects. The chief infectious conditions of this region are **ARTHRITIS** (rheumatism), infections of the tendon sheaths and inflammation of the bones, including tuberculosis. The chief injuries of the ankle-joint are fractures, dislocations, sprains and strains; and stretching or rupture of the ligaments and capsule of the joint. The symptoms of these disturbances are pain, swelling, limp, and stiffness or limitation of motion.

The temporary treatment of an ankle sprain consists

of immediate rest of the limb with elevation on a surface a little higher than the body and the immediate application of cold cloths or ice bags. The cold keeps the inflammation, irritation, hemorrhage and swelling down to a minimum. At a later time, heat is more beneficial in reducing pain. A snug, well-fitting bandage applied immediately will reduce the swelling and thereby minimize the amount of stretching of the supporting ligaments around the ankle-joint.

As soon as possible, a properly applied adhesive strapping will give considerable support, reduce pain, discomfort and swelling, and hasten recovery. After seven to ten days it should be removed and an elastic anklet substituted at which time gentle massage, light exercises and warm and cold footbaths are helpful. *See also* JOINTS AND LIGAMENTS. P. L.

**ANNABERG**, a town in the mountains of Saxony with a fine old church, St. Anne's, built in late Gothic style between 1499 and 1525, and many monuments. In the middle of the 16th century, lace manufacture was introduced in Annaberg. It flourished and made the town the German center of that industry. Other manufactures include silks, buttons and boxes. Pop. 1924, 18,286.

**ANNA COMNENA** (1083-c. 1148), a Byzantine princess and historian, daughter of Alexius I, was born in Constantinople, Dec. 1, 1083. Stripped of her fortune for plotting against her brother in favor of her husband, Nicephorus Bryennius, she betook herself after the death of the latter in 1137 to a convent, where she spent her remaining years writing *The Alexiad*, a detailed account of her father's reign, which completes the history written by her husband at the command of her mother, Irene. The work, which consists of 15 volumes covering the period from 1069-1118, is a rambling chronicle, which is filled with gossip and replete with exaggeration. It was a source of material for several of Sir Walter Scott's romances.

**ANNA KARENINA**, the best known and perhaps the finest of Tolstóy's novels. (*See* Tolstóy, Lióv.) *Anna Karenina*, written in 1875-76, is the story of an attractive but ill-fated woman who forsakes her husband and young son for a lover. It is the powerful history of a love in conflict with social conventions, ending in pitiable misunderstandings and, at the last, in the heroine's suicide. The book affords some remarkably vivid glimpses into the inner workings of 19th century Russian society.

**ANNALS**, as a literary form, are a chronological record of the events of the year. In ancient Rome the *Annales Maximí* were written on a white tablet (album), by the pontifex maximus, and set in a public place. The custom expired with the pontificate of Publius Mucius Scaevola, 131 B.C. In the Middle Ages the calendar of the Church was based on the date of Easter. These dates were written down in pamphlets between blank spaces, important historical events being jotted down in the spaces. These were called annals. The publications of various learned and scientific societies are often called annals, such

as the *Annals of the Academy of Political and Social Science*.

**ANNAM**, a French colony in southeastern Asia, the central district of French Indo-China, between Tonking and Cochin-China. Area 57,954 sq. mi.

The inhabitants are Annamites in the towns and along the coasts, and various tribes of Mois live in the hilly tracts; they are of the Mongolian race. The colony is divided into three districts: northern, central and southern Annam. Mountains near the coast render communication difficult; hence no through railway links southern Annam with Saigon and Cochin-China, and northern Annam with Haiphong.

The climate in northern Annam is cold in the dry season; the rainy period is marked by strong sea breezes. In central Annam the heat is excessive from May to August; the southern district's dry season is especially trying. Annam receives most of its rain between October and February, when the northeast monsoon is blowing across the Gulf of Tonking.

Central Annam centers at Hué, the capital, and its port, Tourane, but the largest town is Bình Định (pop. 70,000). There are many villages adjacent to the rivers which form the principal means of communication. Agricultural products are rice, maize, coconuts, bananas, rubber, tea and tobacco. Plowing is done by water buffaloes, of which there are many; other animals include horses and pigs and a few sheep and goats in the hills. Many of the inhabitants are engaged in spinning silk. Coal and salt are mined.

Annam has a native emperor and a council administering all the internal affairs under the control of the French government. The country was conquered by the Chinese in 214 B.C., but won its independence in 1428. In 1884 it was declared a French protectorate. Pop. 1926, 5,581,000.

**ANNAMESE**, the language of the inhabitants of Annam, spoken on the eastern coast of Indo-China from the bay of Along to Cambodia, and akin to the dialects of the Muong on the lower hills west of Tonking and North Annam. The Annamese word is monosyllabic and without tone, the word-order, combined with independent particles, being the only indication of grammatical function. This is equally true of CHINESE, but despite the deep influence of that language on Annamese, the latter does not seem to be related to Chinese, but to Thai, a distant member of the same family (*see* SINO-TIBETAN). The attempt has also been made to connect Annamese with MON-KHMER, notwithstanding their differences in structure, which are then explained as due to phonetic decay and local influences. Originally Annamese employed Chinese script, with an adaptation of it after the 14th century, but now uses only the Qu'óc-ngũ', a modification of Roman characters invented by missionaries in the 18th century. Its chief literary production is the *Kim Vân Kiều*, a romance of popular inspiration, but in polished verse, written about 1800.

J. B.

**ANNAPOLIS**, the capital of Maryland, and the county seat of Anne Arundel Co., situated on the Severn River, near Chesapeake Bay, and 32 mi. northeast of Washington. It is served by steamboats and the Washington, Baltimore and Annapolis Railroad. Annapolis is best known as the location of the U. S. Naval Academy, and is also noted for its many fine colonial mansions. The city was founded by Puritans; it was known as Anne Arundel Town in 1650, but later changed its name to Annapolis. In 1695 it was incorporated and made the capital of the province. Located here are the Church of St. Anne (Episcopal), founded in 1695, and St. John's College, chartered in 1784. In the old State House, Washington resigned his commission to the Continental Congress in 1783; a year later the peace treaty with England was signed here; and in 1786 the ANNAPOLIS CONVENTION was opened in this historic building. The retail business in 1929 amounted to \$7,877,785. Pop. 1920, 11,214; 1930, 12,531.

**ANNAPOLIS CONVENTION**, Sept. 11-14, 1786, the assembly of delegates from several states, at Annapolis, Maryland, which prepared the way for the Constitutional Convention of 1787. (See CONSTITUTION, UNITED STATES.) Differences over jurisdiction between Maryland and Virginia affecting navigation in Chesapeake Bay and other common waters led to a convention of commissioners from both states in 1777, which accomplished nothing; and a similar convention in Mar. 1785 which, meeting at Alexandria and Mount Vernon, drew up a formal compact for joint control of the common waters. When both legislatures had ratified the compact, the Maryland legislature proposed to that of Virginia a convention representing all the states to agree upon general commercial regulations. The Virginia legislature on Jan. 21, 1786 proposed such a conference to the other states and appointed its commissioners therefor. Delegates from New York, New Jersey, Pennsylvania, Maryland and Virginia assembled in the following September. Because of the inadequate representation and the restrictions placed upon most delegates by their formal instructions, the convention was content with adopting an address framed by Alexander Hamilton, on Sept. 14, which proposed a convention of delegates from all the states to meet in Philadelphia the second Monday of the succeeding May "to take into consideration the situation of the United States, to devise such further precautions as shall appear to them necessary to render the constitution of the Federal Government adequate to the exigencies of the Union," and to report to the Congress of the Confederation.

**ANNAPOLIS NAVAL ACADEMY.** See UNITED STATES NAVAL ACADEMY.

**ANNAPOLIS ROYAL** (formerly Port Royal), a town of Nova Scotia on an arm of the Bay of Fundy, 130 mi. west of Halifax by rail. It is the outlet of the Annapolis Valley which produces fine apples in large quantities. Port Royal was founded in 1605. About the little town cluster romantic memories, more

thrilling than any in Canada with the exception perhaps of Quebec. A fort and village were here three years before a white man had built on the site of Quebec. The first conversion of natives to Christianity occurred at Port Royal. Here the first vessel built in North America was launched, the first wheat and root crops grown, and the first flour mill constructed. The place was renamed in 1710 in honor of Queen Anne. Pop. 1931, 739.

**ANN ARBOR**, a city of southern Michigan, the county seat of Washtenaw Co., situated on the Huron River, about 36 mi. west of Detroit and 247 mi. east of Chicago. Among the transportation facilities are the Michigan Central and the Ann Arbor railroads, motor bus lines and a municipally-owned airport. Located in a good farming country in the beautiful Huron valley and on the surrounding hills, Ann Arbor is a garden spot of Michigan. Good water power is supplied by the Huron River. The manufactures include automobile accessories, machine parts and furniture and wood products, their value in 1929 amounting to \$10,623,198; the retail trade amounted to \$26,083,619. The city park system includes a municipally-owned golf-course of 121 acres. Ann Arbor is best known as the seat of the UNIVERSITY OF MICHIGAN, which was founded there in 1837. The settlement was founded in 1824 and Ann Arbor became a city in 1851. Pop. 1920, 19,519; 1930, 26,944.

**ANNATES**, a sum of money, nominally equivalent to one year's income from an ecclesiastical benefice, paid by the newly inducted incumbent to the Roman Curia, the papal court. In origin and practice the payment of annates seems to parallel the feudal incident primer seisin. In the later Middle Ages annates were required of all bishops and of persons instituted into benefices, the patronage of which was reserved to the Holy See. A valuation of benefices was made in 1253 for the purpose of establishing the amounts due to the papal court in annates and other financial obligations; and an increased valuation was made by Pope Nicholas III in 1292. There was little uniformity in the system; some popes set aside the rights of patrons and endeavored to present to, and consequently to receive annates of, benefices that were not normally in their presentation. In England the payment of annates to the pope was forbidden in the reign of Henry VIII and they were transferred to the Crown. In the Catholic Church to-day annates are levied only on dioceses not subject to the congregation of propaganda.

**ANNATTO**, called also arnotto, a yellowish-red dyestuff obtained from the pulpy seed-coverings of a tropical American tree (*Bixa Orellana*) of the bixa family. The tree grows usually about 12 ft. high with large, entire, heart-shaped leaves and showy, pinkish or rose-colored flowers borne in terminal clusters. It is extensively cultivated in the West Indies and also in India where it has become naturalized. Annatto is the chief material used to color butter and cheese; it is also used in dyeing silks, in coloring varnishes and lacquers and in preparing chocolate.

**ANNE** (1665-1714), Queen of Great Britain and Ireland, and younger daughter of James II, was born Feb. 6, 1665. She ascended the throne in Mar. 1702, having sided with William of Orange in the Revolution of 1688. Outstanding among the events of her reign were the union of Scotland and England, 1707; the last royal veto and the acceptance of the theory that the ministers must represent the majority in Parliament; the great revival in English literature associated with Dryden, Pope, Addison and others; and the war of the Spanish Succession (1702-13) in which England captured Gibraltar in 1704 and greatly increased her sea power. An ardent churchwoman, she antagonized the Whig ministers, and for a considerable part of her reign she was under the influence of the Duchess of Marlborough, the wife of the successful general in the War of the Spanish Succession. She died, Aug. 1, 1714.

**ANNE OF AUSTRIA** (1601-66), Queen of France, was born in Madrid, Sept. 22, 1601. Anne was the daughter of Philip III of Spain and in 1615 married Louis XIII of France. Cardinal Richelieu's constant accusations of conspiracy both false and based on fact made her marriage a most unhappy one. At the death of Louis XIII in 1643, Anne assumed the regency for her young son Louis XIV. Cardinal Mazarin, to whom she is said to have been secretly married, served as able Minister of State during the period of her regency which lasted until 1661. Anne died Jan. 20, 1666.

**ANNEXATION**, the act or process by which a state claims possession and secures title to territory. Inhabitants of the new territory either become subjects or citizens (*see* CITIZENSHIP) of the annexing state, or are given a definite time within which to declare an intention to retain their former allegiance, or to remove from the country. The public laws of the annexed area are displaced by the public laws of the new state immediately upon the formal transfer or ACQUISITION of the territory. The private laws remain unchanged until expressly altered by the legislative authority of the acquiring state. The methods of annexation are the same as those of acquisition. Mere discovery and military occupation do not give valid title.

**ANNISTON**, a city of northeastern Alabama, the county seat of Calhoun Co., situated in the lower Appalachian Mountains, 57 mi. east of Birmingham. It is served by the Southern and the Louisville and Nashville railroads. There is a commercial airport, also an army airport near by. Anniston is in a cotton-growing region, with natural resources of limestone, timber, and iron. The city has cotton and planing mills, a large electro-chemical plant, cast-iron pipe works, textile mills and numerous other industrial establishments. In 1929 the manufactures reached approximately \$10,000,000; the retail trade amounted to \$9,774,459. Its educational institutions include Alabama Military Institute, founded in 1904, and Barber Memorial Seminary for Colored Women, a Presbyterian institution, founded in 1896. The

city was founded by Samuel Noble and Alfred Tyler in 1872. It was incorporated as a city in 1883, and rapidly began to grow in population. Pop. 1920, 17,734; 1930, 22,345.

**ANNONAY**, an old city in the department of Ardèche, France. It is built on a hill at the confluence of the Cance and Déôme; has a fine 14th century Gothic church, a college, museums and libraries. Paper, glove factories and tanneries are among the industries. In the rich soil of the neighborhood fruit and mulberries are grown. Due to its remoteness Annonay became an asylum of the Calvinists. Pop. 1931, 15,427.

**ANNUALS**, plants that complete their life cycle in one year, as distinguished from biennials and perennials. Most farm and garden crops are annuals, as well as many cultivated flowers such as marigold, sweet alyssum and morning-glory. As wild plants annuals are much less common than biennials or perennials. Some garden plants, usually grown as annuals, like the castor-bean, snapdragon and hollyhock, are actually BIENNIALS, or even PERENNIALS in warmer climates.

**ANNUITY**, a sum of MONEY paid annually to a specified person or persons over a stated period of years. The money may be paid in instalments throughout the year as well. A life annuity, the simplest form, is paid during the life of the one receiving the money, who is called the annuitant. A perpetual annuity is paid forever, passing from heir to heir. A deferred annuity becomes payable after a certain specified date. A contingent annuity ceases to exist upon the occurrence of some specified event, such as the marriage of the annuitant.

The terms and conditions that may govern an annuity are almost unlimited, and are arranged either by will or by contract. The testamentary method is the oldest, having been devised before the beginning of the Christian Era to replace a lump sum legacy with periodic payments. It is still practiced in Europe, with the result that many private estates are heavily incumbered by the charges imposed upon them; a matter of great political and social importance to-day. The contract method is more modern, being an arrangement made with an incorporated organization such as an insurance company. A certain sum is paid for the annuity, the price being governed by the size of the yearly payment desired, and details of payment are outlined in the form of a contract. This is closely akin to LIFE INSURANCE, which is the child of the annuity system. Legally, annuities are considered personal property, whether charged to the grantor in person or against a specific real or personal estate. If the annuity is inherited or devised, however, it is held to be personal property.

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**ANNUNCIATION**, the ecclesiastical term for the visit of the Archangel Gabriel to the Virgin Mary, at which the conception of Jesus was announced. The Feast of the Annunciation falls on March 25, and there

are several religious orders of the Annunciation, one of them founded by St. Jeanne de Valois (1464-1505), daughter of Louis XI of France and queen of Louis XII. To medieval artists the scene of the Annunciation, in which the splendor of the angel contrasted with the modesty of the maiden, is an ever-fascinating subject.

**ANNUNZIO, GABRIELE D'** (1863- ), Italian poet, novelist, dramatist and soldier, was born near Pescara, Abruzzi, in 1863. He began writing and publishing verse at an early age, and on going to Rome in his latter teens was hailed as a youthful prodigy. During the next decade, roughly 1890-1900, he began writing the dramas by which he is chiefly known in English-speaking countries. Among them are *The Dead City*, *La Gioconda* and *FRANCESCA DA RIMINI*. His novels include *The Child of Pleasure*, translated into English in 1898, *The Triumph of Death*, *The Maidens of the Rocks* and *The Flame of Life*. The World War stopped temporarily D'Annunzio's prolific production of fiction, drama, essays and verse and, although previously considered an aesthete and a decadent, he served actively in the Italian army and navy and as an aviator won attention by many daring exploits. Violently opposing the provisions concerning FRUME of the Treaty of Versailles, he led troops into that city and defiantly held it for 15 months. A strong supporter of Fascism, in 1924, D'Annunzio received the title of Prince of Monte Nevoso. See also DUSE, ELEANORA; ITALIAN LITERATURE.

**ANNUS MIRABILIS** (The Wonderful Year), the name given by John Dryden in a poem bearing that title, which celebrates the Plague, the Great Fire and the naval victory of 1667 in the war with Holland. The poem, which is in panegyric verse, was published in 1667 and dedicated to "The Metropolis of Great Britain, the most renowned and late flourishing City of London."

**ANODE**, that terminal of an electrolytic cell (see ELECTROLYSIS) or electronic tube (see TUBES, ELECTRONIC) through which the electric current enters. The terminal through which the current leaves the cell is the CATHODE. The current contemplated in this definition is the positive current. According to the ELECTRON theory, an electric current in a metallic conductor consists of a stream of electrons; since electrons carry negative charges, it follows that this stream moves against the so-called positive current. Hence, the anode of an electrolytic cell or vacuum tube is actually the terminal by which the current leaves.

L. B. S.

**ANOKA**, a city in southeastern Minnesota, the county seat of Anoka Co., situated on the Mississippi and the Rum rivers, 18 mi. northwest of Minneapolis. Bus lines and two railroads afford transportation. The city is a market and shipping center for grain, milk and vegetables. It manufactures chiefly furniture and ammunition. The State Hospital for the Insane is located here. Anoka was visited in 1680 by Father Hennepin. The city was founded in 1832

and incorporated in 1878. Pop. 1920, 4,287; 1930, 4,851.

**ANOMALY**, in astronomy, the angle in a celestial orbit, measured at the sun, between the PERIHELION, and the position of the planet or comet at the time considered.

**ANOPELEURA**, the scientific name for an order of insects commonly known as lice. The order is divided into two suborders, the true lice (*Siphunculata*) and the bird-lice (*Mallophaga*). These insects live as parasites on mammals and birds. They are small and somewhat flat, without wings, and are protected by a hard horny cuticle.

Bird-lice have their mouths modified for biting. They eat hair, feathers and outside skin scales. Sometimes they infest mammals as well as birds.

True lice have sucking mouths, and live on blood. Several species attack human beings. The most common is *Pediculus humanus*, which may act as a carrier of typhus and other diseases.

**ANORTHITE**, a rock-forming silicate belonging to the PLAGIOCLASE series of FELDSPARS. It is white, grayish or reddish in color, and varies from transparent to translucent. Mixtures of anorthite, calcium aluminum silicate, with ALBITE, sodium aluminum silicate in varying proportions make up the PLAGIOCLASES. Anorthite, like albite, crystallizes in the TRICLINIC SYSTEM. ANDESITES, DIORITES and GABBROS frequently contain anorthite which has also been found in some volcanic LAVAS, such as those from Mt. Vesuvius and in basalts from Fujiyama, Japan. See also PETROLOGY.

**ANOXEMIA**, or a deficiency of oxygen in the blood, causes nausea, headache, blueness of the skin, rapid breathing and sometimes fainting. It may occur in pneumonia and heart disease. It also occurs at high altitudes as a result of rarity of oxygen at such low atmospheric pressures. The disturbance known as AIR-SICKNESS is partially due to anoxemia.

**ANSBACH**, a town in Bavaria located on the Rezat River about 27 mi. southwest of Nürnberg. It has a church, built in 1441, containing the graves of the former margraves of Ansbach. The former castle has a collection of books and pictures. There are fine monuments and gardens and diversified industries. Its town hall was built in 1531 as a country house. The town grew up around an abbey built in 786. Pop. 1925, 21,923.

**ANSELM, SAINT** (1033?-1109), Italian scholastic philosopher, was born at Aosta, Piedmont, in 1033 or 1034. In 1060 he went to the monastery at Bec, Normandy, to study under Lanfranc. Here he remained 33 years. In 1078 he became abbot of the monastery and made it the outstanding center of learning in Europe. In 1093 Anselm was made Archbishop of Canterbury but four years later was banished by William Rufus after a series of disputes over the King's refusal to recognize Urban as Pope. During his exile he wrote *Cur Deus Homo*, his greatest work. He was recalled by Henry I in 1100, but soon there was dissension over the question of kingly investiture

which Anselm strongly opposed. In 1107 Henry I submitted. Anselm died at Canterbury, England, Apr. 21, 1109.

See Dean Church, *St. Anselm*, 1892.

**ANSHAN IRON MINES**, the Japanese-controlled iron mines in Manchuria, about 70 mi. south of Shenyang (Mukden) on the SOUTH MANCHURIA RAILWAY. The ore deposits in the mining area, of about 10 sq. mi., total between 125,000,000 and 150,000,000 tons of ore, but the ore is of comparatively poor quality (35% to 40%). The rights to mine in this area were secured by Japan as a result of the RUSSO-JAPANESE WAR, 1904-5. In 1914 a Sino-Japanese company was formed to do the mining, while the SOUTH MANCHURIA RAILWAY COMPANY undertook the production of pig iron from the ore. Pig iron was first produced in 1919. After considerable experimenting, the Japanese evolved a concentration method which made it possible to produce pig iron at commercially practicable costs. The total production, in the period 1919 to 1929, has been something over 1,000,000 tons of pig iron; annual production has grown from 31,620 tons in the first year to around 220,000 tons. Steel production at the Anshan Iron Works started in 1931.

**ANSON, ADRIAN CONSTANTINE** (Pop) (1852-1922), celebrated baseball player and manager, was born at Marshalltown, Ia., Apr. 17, 1852. In 1873 he began his major league career with the Philadelphia Athletics, signing with the Chicago White Sox in 1876, and becoming manager the following year. Anson was a consistent batter, making 3,013 hits in 8,947 times at bat during 1876-98, and one of the best first basemen in the game of the 80's and 90's. Under his management the White Sox won the National League pennant five times during the period 1880-86, and in 1885 won the world's championship. He enjoyed great popularity with baseball enthusiasts, due to his aggressiveness and to his eminent fairness. He died at Chicago, Apr. 14, 1922.

**ANSONIA**, a city of New Haven Co., in southwestern Connecticut, situated on the Naugatuck River, 13 mi. northwest of New Haven, served by bus and trolley lines and the New Haven Railroad. Ansonia was founded in 1840, and named for Anson Green Phelps. At one time it belonged to the town (township) of Derby. It received its charter as a borough in 1864, as a town in 1889, and as a city in 1893. Ansonia is an important industrial center, manufacturing heavy machinery, wire, copper and brass products and textiles. In 1929 the factory output reached an approximate total of \$62,000,000; the retail trade amounted to \$6,435,795. The Ansonia clocks were originally manufactured here. In the vicinity are Pork Hollow and the Housatonic River State Reservation. Pop. 1920, 17,643; 1930, 19,898.

**ANSWER**, in equity pleading, the formal written statement of defendant's case with categorical answers to each of the charges made by the plaintiff and questions put to the defendant in plaintiff's bill. Under codes of civil procedure and practice acts it takes the place of the answer in chancery and the plea at law.

In modern English practice it is called a Statement of Defense.

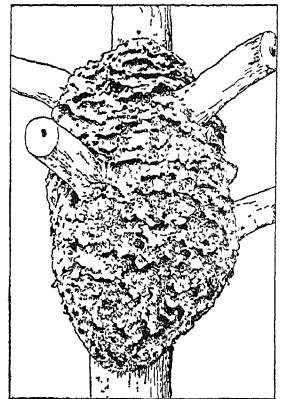
**ANT**, the vernacular name applied to hymenopterous insects of the family *Formicidae*. There are over 3,500 described species of ants, and they occur in all regions of the world, but are much more numerous, diverse, and aggressive in tropical countries where their individuals probably outnumber all other kinds



NEST OF A MOUND-BUILDING ANT  
The mounds built by *Formica exsectoides* occur chiefly in the Alleghenies and are often 3 to 4 ft. in diameter and 1 to 2 ft high

of animals. Ants are all social insects and are derived from the vespoid wasps.

**Castes.** Complex polymorphism is a characteristic of ants. The highly conservative males maintain their primitive wasp-like structure. In the females there is a much greater differentiation and range of structure, 21 different forms being recognized, of which some are produced by pathological conditions. The typical female castes are the queen, the worker and the soldier. The queens and males have wings, those of the former being shed after the nuptial flight. The worker and soldier castes are sterile, wingless and with correspondingly reduced thoracic structure and small eyes. The latter caste are distinguished by a huge head, with mandibles adapted to fighting, seed-crushing or similar activities.



COURTESY AMER MUS OF NATL HISTORY

TREE NEST OF ANTS  
This nest, made by *Azteca lanuginosa*, was found at Santa Catharina, Brazil

Coition normally occurs only during the nuptial flight, after which the male dies. The sperm is kept alive in the body of the queen for many years. After her flight the queen divests herself of wings and excavates a burrow, in which she seals herself for a period of months until she has raised her first brood of miniature workers from the content of her own body. Thereafter the workers assume the labors of the colony and the queen restricts herself to egg-laying.

**Architecture.** The nests of ants may be merely winding galleries and irregular chambers underground or in wood, without distinctive external fea-



tures; or the openings may be marked by craters or mounds of earth or debris. Many tropical ants construct nests of earth, cotton, or silk in trees. Only larvae are able to spin silk, and certain ants have the habit of holding them in their jaws and using them as a tool or shuttle for spinning. The cavities of plants are often used for nesting, and in the tropics, the swollen bases of thorns, bulbous growths filled with cavities, and the like.

**Leaf-cutting Ants.** Ants of the tribe *Attini* cut pieces from the leaves of trees and store them in chambers in their nests, where they become compost heaps on which a particular kind of fungus is grown, and the latter serves as food for adults and larvae. The virgin female carries a pellet of fungus from her maternal nest, and with it starts a new culture in the nest that she founds.

**Legionary Ants.** Some ants known as legionary or driver ants (*Dorylinae*), have no fixed habitations, but establish temporary bivouacs wherever they find adequate shelter. Their foraging columns are familiar to all persons in the tropics. In some instances they may be several feet in width and of enormous length, and they scatter or destroy every living creature in their path, not infrequently entering human habitations. Migrating columns carry with them their queen, immature stages and camp-followers, or myrmecophiles.

**Parasitic and Slave-making Ants.** Social parasitism (See SOCIAL INSECTS) has been extensively developed among ants, resulting in such extremely degenerate forms as *Anergates*, in which the males are wingless, pupa-like and mate within the nest with their own sisters, and in which the worker caste is lost, the species being dependent upon the workers of their host-species to raise the brood and feed the adults. Another type of parasitism is exemplified by the amazon ants (*Polyergus*). The queen amazon ant secures adoption into a colony of her host-species, and subsequently kills the queen of the latter. The host-workers adopt and raise her brood, which consists wholly of soldiers, incapable of feeding themselves, or of sharing in the labors of the colony. By reason of long piercing mandibles the soldier amazons are fitted for fighting and piercing the heads of their victims. They conduct forays against colonies of their host-species, capturing the young, which are brought home and reared by the slaves to a life of slavery. Thus a continuous supply of slaves is obtained.

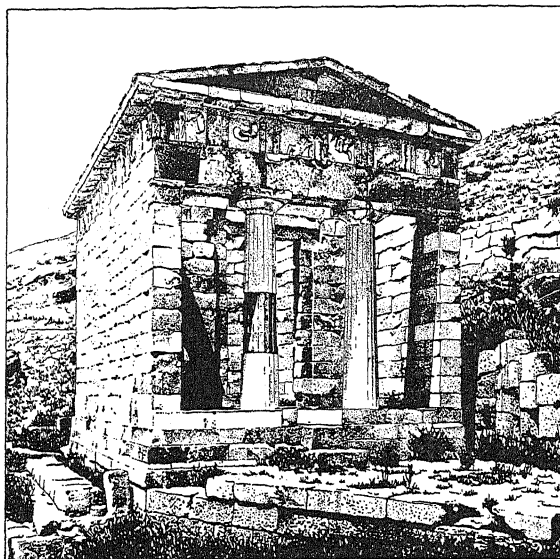
J. C. B.

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**ANTACIDS**, substances which neutralize acidity and are widely employed in medicine. The most commonly used is **SODIUM BICARBONATE**, which is both a gastric and systemic antacid. Others, such as calcium hydroxide or lime, calcium carbonates and phosphates, magnesium hydroxide or milk of magnesia, magnesium carbonate, and magnesium phosphate, act as gastric antacids with little effect as systemic antacids.

Citrous and certain other fruits also act as antacids in the body. (See also BUFFER ACTION.)

**ANTAE**, the decorated ends of screen walls enclosing the sides of a porch, especially in Greek architecture. In primitive times, when walls were of sun-dried brick, their ends were protected by a sheathing



THE TREASURY OF THE ATHENIANS AT DELPHI SHOWING ANTAE IN THE EAST FAÇADE

of vertical planks, with moldings at top and bottom. Later, the general form of this protection was preserved in stone architecture. Columns in a porch between the ends of these walls are known as "in antis."

**ANTAEUS**, son of **POSEIDON**, lord of the sea, a giant and wrestler in Libya. As long as he remained in contact with the earth his strength was invincible. **HERCULES** discerned the secret of his might and, lifting him from the ground, was able to crush him in the air.

**ANTANANARIVO** or **TANANARIVO**, capital of the island of Madagascar, situated on a high ridge about 85 mi. from the eastern coast and 140 mi. from **TAMATAVE**. With its old palaces, church steeples and gables, the city presents a picturesque appearance. It was once the headquarters of the native chieftains. The principal articles of commerce are rice, coffee, cotton, tobacco and wool. Silk and cotton weaving and meat-preserving are the main industries. In 1926 the population was 70,847, of which 3,648 were French and 601 British and other foreigners.

**ANTARCTICA**, the continent surrounding the South Pole, occupying the greater part of the South Frigid Zone. It is about 3,400 mi. in length from Joinville Land to Adelie Land, about 2,800 mi. from Charcot Land to Graussberg, and 2,500 mi. from Coats Land to Oates Land. Mawson and Bruce compute its area to be more than 5,000,000 sq. mi.

**Surface Features.** The broad features of the map of Antarctica are not so much built on ascer-

tained fact as on intelligent guesswork. The region is covered almost entirely by a great dome of ice rising from the coasts to interior elevations of some 10,000 ft. The ice-cap completely masks the underlying surface features except for certain mountain ranges that tower above the ice, a few isolated peaks, or nunataks, and in places bare rocks near the coast. In many parts the outflowing ice-cap overrides the coast and projects into the ocean, ending in lofty ice cliffs whence great fragments float away as icebergs. The only known possible exception to the elevated tablelands is the interior of King Edward VII Land and its extension eastward.

The plateau of SOUTH VICTORIA LAND, discovered by Capt. R. F. SCOTT, averages at least 6,000 ft. above sea-level. In 1904 Scott traveled over this plateau for 150 miles, at a height of nearly 9,000 feet. Professor T. W. Edgeworth David, several hundred mi. to the north of Scott's route, found the height to range from 6,000 to 7,000 ft., the latter altitude being his average for 100 mi. Mawson's party, to the north of David's turning point, found the height to be 5,900 ft., and still slowly rising from the coast of King George V Land. In 1929, BYRD discovered a new range when he was flying west by south of Scott's route. These Rockefeller Mountains, as he named them, begin roughly in  $78^{\circ} 14' \text{ S. lat.}, 155^{\circ} 15' \text{ W. long.}$ , and extend in crescentic shape to  $77^{\circ} 35' \text{ S. lat.}, 153^{\circ} 5' \text{ W. long.}$  There are some 40 peaks and ridges ranging in height from about 500 ft. to more than 2,000 ft. above sea-level. The discovery of these mountains adds greatly to the known areas of King Edward VII Land. Beyond this region to the east Byrd saw more mountains in an area which he named Marie Byrd Land. Graham Land and Smith Victoria Land are the two best explored regions, Graham Land, which Wilkins proved was two large islands and not a peninsula of the continent, contains mountains which must once have been continuous with the Andes of South America. South Victoria Land is a plateau bounded along the Ross Sea by a great horst (an elevated crustal block bounded by scarps), some 50 to 100 mi. wide and rising from 13,000 to 15,000 ft., which is 2,000 to 9,000 ft. above the surface of the ice-cap. This horst, lying between parallel faults, makes the great mountain ranges of over 1,300 mi. along the western side of the Ross Sea and the Great Ice Barrier, which are known in different parts as the Prince Albert Mountains, the Royal Society's Range, the Commonwealth Range and the Queen Maud Range. Transverse faults form great valleys by which the ice-cap flows to the Ross Sea. Folds are absent in the plateau and horst. Along the eastern fault that bounds the horst can be traced a line of volcanic activity. The Great Ice Barrier, which extends along the coast for about 400 mi., is on the side nearest New Zealand, 1,600 mi. away. All polar explorers have landed on that side because the Ross Sea, extending inland, shortens the overland distance to the pole. The dominating volcano of Erebus towers over 13,000 ft. above Ross Sea and together with its ex-

tinct neighbor, Mount Terror, practically forms Ross Island.

Antarctica's most prominent feature is its dissimilarity from other continents. It has no water, apart from the sea which encircles it, and this, near the coasts, is almost invariably frozen. It has no rivers except a few small glacial streams whose bonds are unsealed, occasionally, in summer. There are no lakes and few frozen pools. It is doubtful if one% of Antarctic lands is ever ice-free, so that ordinary forms of land life are entirely wanting. There are no human communities south of Cape Horn, more than 2,000 mi. from the pole, though the Argentine government maintains a weather outpost at Scotia Bay, South Georgia, whose force is changed annually. The whale fishing industry is one of great value in the territorial waters and is being exploited mainly by Norwegians.

Antarctica has not always been ice-clad. There are vast deposits of coal, extending 1,400 mi. from the ranges in South Victoria Land to the sandstone nunatak of King George V Land. This indicates that in a past geologic age it was a warm region with abundant vegetation, and Shackleton found fossil wood and rootlets, Scott sent back fossil leaves and Priestly found large pieces of wood, apparently coniferous.

**Climate.** No month in Antarctica has a mean temperature above freezing point. Summer is an astronomical conception; it is warmer than the winter, but is nevertheless a cold period. At Cape Adare, South Victoria Land, the warmest month shows a mean of  $31.6^{\circ}$ ; at the Ross Barrier edge  $19.9^{\circ}$ . The mean of the coldest winter month, at sea-level, is  $-14.5^{\circ}$  at Cape Adare and  $-48.6^{\circ}$  on the edge of the Barrier. Absolute minima of  $-73^{\circ}$  and  $-77^{\circ}$  have been recorded on the Barrier in mid-winter. The great ice-covered continent acts as a reservoir of cold. The summer insolation has little effect on melting its surface and the surface air-currents are chiefly southerly and therefore cold. Hence, snow lies practically at sea-level throughout the year and temperatures remain low.

**Flora and Fauna.** Vegetable life is practically absent, save a sparse growth of mosses, lichens, fungi and freshwater algae. No flowering plants occur. The terrestrial fauna consists of wingless species only. The marine life is more abundant than in other oceans, the highest forms being whales, seals and wonderful birds: skua gulls, snow petrels and various species of penguins. The Emperor and Adelie penguins spend about eight months ashore on the mainland and four months on the pack ice. Their eggs are excellent eating, large quantities being consumed by explorers. The adult bird, when cooked, makes a good dish for the table. Fossils of penguins have been found in the later Tertiary rocks. While no accurate census has been taken of these ancient inhabitants of Antarctica, careful estimates have been made that some of the groups in which they gather must contain 750,000 birds. The finest Antarctic penguin is the dignified *Emperor* (*Aptenodytes fos-*

teri). He is about 4 ft. high, weighs 90 lbs. and has very rich coloring. His food consists of fish and cuttle-fish, with pebbles to grind up the bones.

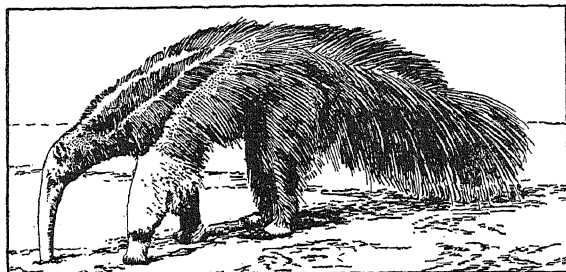
**ANTARCTIC OCEAN**, or Southern Ocean, a vast body of water surrounding the south polar regions. It is bounded on the north by a line running from Cape Horn to Cape Agulhas which separates it from the Atlantic; a line from Cape Agulhas to Cape Leeuwin which separates it from the Indian Ocean; the southern shore of Australia; the southern extremity of the Tasman Sea; and a line from New Zealand to Cape Horn which separates it from the Pacific. Below this boundary the Antarctic Ocean forms a continuous belt of water around the globe and extends southward to the irregularly shaped antarctic continent. The latter is indented by two arms of the ocean, the Weddell and Ross seas. It consists of a great plateau rimmed with towering mountains and covered by a snow and ice cap which extends in a shelf-like manner over the surrounding water. A notable example is the Ross Ice Barrier, which is estimated to be 400 mi. wide from north to south and extends to the east indefinitely. It is largely water-borne and in thickness varies from a few feet to 200 ft. above the water; it is sometimes 500 ft. thick beneath.

The submarine relief of the Antarctic, viewed broadly, consists of three vast depressions at some distance offshore, separated by three crustal uplifts. They are called the Pacific, the Atlantic-Indian and the Indian basins in accordance with the oceans at whose southernmost extremities they lie. The first and second are separated by the Antarctic Archipelago; the second and third by the Kerguelen-Gaussberg Ridge; and the third and first by a nameless uplift indicated by the Macquarie and Balleny islands. They average 18,000 ft. in depth. A special individual feature is a trench 26,575 ft. deep on the east side of the South Sandwich Islands.

**ANTARES** (*Alpha Scorpii*), a star of the first magnitude and the brightest star in the constellation of the SCORPION. The name, a Greek word meaning rival of Ares (Mars), is derived from its deep red color. Antares is a typical red giant, and the largest star whose size has thus far been measured, its diameter being 450 times greater than that of the sun, or about 400 million miles. It could easily engulf the entire orbit of the planet Mars. The gases of which this star is composed are, on the average, a thousand times as tenuous as the air we breathe; yet it sends forth 3,500 times as much light as the sun. Its distance is 360 light years. See STAR: map.

**ANTEATER**, one of the largest of edentates, the great anteater (*Myrmecophaga jubata*) of South America is an entirely toothless, inoffensive, clumsy mammal which lives exclusively upon ants. Its shaggy body, ashy-gray, conspicuously marked with black and white, ends in a prodigious plummy tail. The narrow head tapers into a very long tubular snout. Armed with strong, curved claws for tearing open ant-hills, it shoots from a tiny round mouth an elongated, worm-

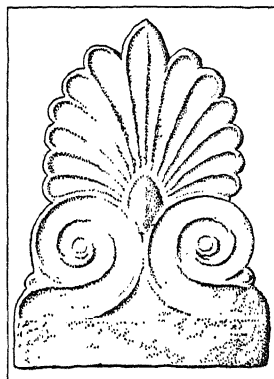
like, extensile tongue to lap up swarming ants. Terrestrial and nocturnal in habit, it hides by day from jaguar and other enemies under the thatch of its own



ANTEATER

over-arching tail. Other smaller species of anteaters are found in South and Central America.

**ANTEFIX**, a decorated end tile used to finish the covering tiles of a classic roof at the eaves. It is usually oval in profile, and its face is often ornamented with an anthemion.



COURTESY P. P. CAPRONI &amp; BROS.

ANTEFIX, FROM THE PARTHENON, ATHENS

**ANTELOPE**, a member of a numerous sub-division of the family Bovidae, readily recognized by the graceful, deer-like form, smooth and sometimes brightly ornamented coat, slender, usually black horns, ringed or twisted, rising from top of the skull and curved backwards or bent like the frame of a lyre. The horns may be long enough to reach back to the animal's shoulders or may be mere spikes, and in some species are borne by both sexes. Antelopes are grazers, and most of them belong to plains or deserts. They are among the swiftest runners, and most agile jumpers in the animal world, and are endowed with remarkably keen warning senses.



COURTESY AMER. MUS. OF NATL. HISTORY

MALE SABLE ANTELOPE

Economically, antelopes are valuable animals, highly prized for their flesh and hides, and, in the case of some species, for their horns. For the most part they are not destructive to growing crops or otherwise injurious to agriculture. In Africa various antelopes have been the principal dependence of meat supply for the beasts of prey and for the native peoples throughout very large areas. The relatively few kinds of antelopes found in Asia

are of similar value in districts where they are abundant.

Represented by upwards of 135 species, ranging in size from little dikdiks about a foot high to the horse-like gnu and the oxlike eland, antelopes formerly lived in vast commingled herds in the more open and grassy regions of eastern and southern Africa, constituting the most striking feature of its fauna. Owing to unceasing destruction by hunters, their numbers have very greatly diminished throughout many extensive districts.

As regards numbers, both of genera and species, the antelopes comprise by far the major part of the ox family (*Bovidae*). Of some 200 species belonging to this family fully three-fourths are antelopes. By zoologists these are classified in several, usually from five to twelve, more or less distinctly marked subfamilies. According to W. L. Sclater there are about 150 species of antelopes, of which 138 are found exclusively in Africa and the remainder in Asia. They are distinctly an Old World group and restricted for the most part to a single continent. The so-called American antelope or pronghorn, which belongs to a separate family, differs from the true antelopes and from all other bovine animals in having a branch on its horns, which, like those of the deer, are shed periodically. Unlike various members of other subdivisions of the *Bovidae*, as the ox, water buffalo, goat, sheep, and zebu, none of the numerous antelopes has been domesticated, though the young of some species, as the blackbuck, are readily tamed and become fairly docile pets.

The antelope group contains many genera and a great number and variety of species, from the ELAND, 12 hands high, to the tiny dikdiks and the royal antelope 10 in. tall at the shoulder. These may be grouped in five sections. First come the Bubaline section, containing the hartebeests and gnus of Africa; next the Cephalophine genera, containing the little African duikerboks, klipspringers and royal antelope, 10 in. high. The numerous large waterbucks, reedbucks and cobs belong to the Cericaprine section; and the Antilopine section includes the Indian BLACKBUCK, certain African species and the gazelles. Finally, in the Hippotragine section are grouped the splendid sable antelope, roan antelope, eland and other large handsome African species. For additional details concerning this interesting group of mammals see the separate articles on various important antelopes under the names by which they are most commonly known, as ADDAX; BLACKBUCK; CHIRU; CHOUSINGHA; DUIKER; ELAND; GAZELLE; GNU; HARTEBEEST; KLIPSPRINGER; KUDU; ORYX; NILGAI; SAIGA. E. I.

**ANTELOPE, AMERICAN.** See PRONGHORN.

**ANTELOPE SQUIRREL** (*Ammospermophilus leucurus*), a ground SQUIRREL found in the desert regions of the Southwest. Its body is seldom over 5 or 6 in. long; a grizzly gray on the upper part of its body, and white beneath. The short, flat, bushy tail, glistening white on the under side, is carried turned up over the squirrel's back when it is running, and distinguishes the antelope from all other ground squirrels. It lives in sandy burrows and eats plants

and seeds, and may cause damage to newly-planted grain in the spring.

**ANTENNA**, a network of conductors placed at some distance from the ground, or from a second network of conductors called a COUNTERPOISE, and used as a radiator of electromagnetic power (see ELECTROMAGNETIC WAVES) from a RADIO TRANSMITTER or as a collector of power for a RADIO RECEIVER.

For transmission with a relatively large percentage of power in the GROUND WAVE, a simple vertical wire may be used. A horizontal section added to the vertical section at the top forms either a "T" or an inverted-"L" antenna, both of which are used for transmission and reception.

For ordinary broadcast reception, an inverted-"L" antenna is usually most satisfactory. However, for reception of signals of a single FREQUENCY, the horizontal section may be increased until the antenna is not only resonant for the incoming signal (see RESONANCE), but is long enough so that a number of standing electrical waves can be built up on it at the frequency of the signal being received. Such a device is called a WAVE ANTENNA. It has marked directional characteristics, and, since it is remarkably efficient at the one frequency for which it is built as compared to others, it shows a high signal-to-noise ratio. Such antennas are used for dependable transatlantic reception.

More complicated forms of radiating structures are used for beam transmission and for radio beacons. See RADIO BEACONS AND DIRECTION FINDERS.

L. G. H.

**ANTEQUERA**, a city of southern Spain in the province of Malaga, situated on a fruitful plain. The ruins of a Moorish citadel and a Roman triumphal arch are found here. Weaving mills and trade in agricultural products constitute the city's activities. Est. pop. 1929, 31,000.

**ANTHELMINTHICS**, or vermicides, remedies employed against intestinal parasites. It is not easy to rid the bowel of these worms that find in it their natural habitat and are endowed with suckers and hooks to maintain a hold on its wall. The word "vermicides" is a misnomer, for these agents do not kill the worms, as any drug strong enough to kill invading parasites would have a toxic effect on the patient. Rather, they either narcotize the worm (chloroform, carbon tetrachloride, thymol); paralyze its muscles (male fern); or throw it into convulsions (santonin).

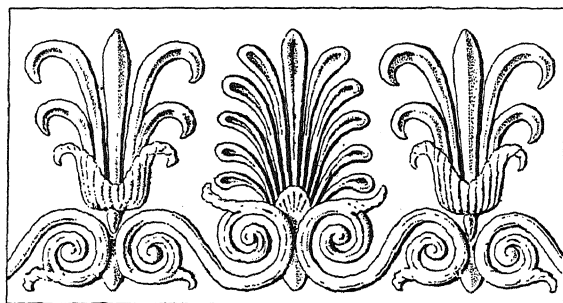
They are potentially harmful drugs, and should be resorted to only when microscopic examination of the stools shows the bodies or eggs of one of the various kinds of worms. They should, therefore, be administered to an empty bowel to obtain the maximum concentration, and in combination with or followed by a powerful purgative (called "vermifuge") to rid the intestine of the worms before they can again attach themselves.

Tests of the efficiency of anthelmintics have been made on earthworms, as drugs potent against para-

sitic worms have been found markedly toxic to these creatures. The various anthelmintics are, however, more efficient against certain of these parasites than against others. Thus against tapeworms, male fern and pelletierine have been found especially efficacious; against round worms, santonin, oil of chenopodium and spigelia; against hookworms, carbon tetrachloride, thymol and oil of chenopodium; while against threadworms, inhabiting chiefly the large intestine, enemas are used, containing quassia, salt, or ferric chloride, or a mixture of anthelmintics. See PARASITIC DISEASES. B. F.

**ANTHEM**, a hymn sung responsively or antiphonally, found its earliest development in England where the graciousness of the Anglican service proved peculiarly hospitable to semi-formal choral renderings of the Psalms. The word, probably derived from anti-hymn, or hymn sung by parts of the choir alternately, now signifies a sacred composition for four or more accompanied voices, in many cases interspersed with solos. Byrde, Tallis, Gibbons, and Purcell are among the foremost English composers of the 16th and 17th centuries who laid their talents frequently at this altar.

**ANTHEMION**, a decorative motive developed by the Greeks from earlier Asiatic, Aegean and Egyptian lotus forms; sometimes known as the "Honeysuckle." The two most common forms are a group of leaves or petals symmetrically arranged rising and spreading



ANTHEMION FRIEZE FROM THE ERECHTHEUM, ATHENS

from a central button or pod to form a generally oval shape, and an arrangement of three or five curving rays or petals somewhat similarly placed. Anthemions were painted and later carved on architectural moldings; they were among the most common ornaments for painted vases. Later Roman, Byzantine and Romanesque types show much variety.

**ANTHOLOGY**, a collection of choice passages in verse and prose. In the modern sense it is a collection of poems, independent of one another from various writers. The word anthology means a "garland of flowers." The Greeks developed the art of occasional poetry, beginning with inscriptions on monuments and tombs, and reaching the height of pure literary expression. In the 1st century B.C. Meleager of Gadara collected the finest Greek poetry into one book known as *The Garland*. Various other Greek anthologies followed, notably *The Circle*, compiled

by Agathias of Murina. This poetry has been of immeasurable influence on European literature. Many English translations have been made of the Greek anthology. *Anthologia Polyglotta*, by Dr. Wellesley of Oxford, is a brilliant collection of the best translations in all languages.

The Latin *Anthology* was not made until about 1773 by Peter Burman the Younger. It was known also as *Anthologia Veterum Latinorum Epigrammatum et Poematum*. This is more varied than the Greek but by no means of as high a literary standard.

The modern popular English anthologies are numerous. Among them are the *Oxford Book of English Verse*, edited by Sir Arthur Quiller-Couch, and Palgrave's *Golden Treasury*.

**ANTHONY, ST.** (c. 251-356?), founder of organized Monasticism in the Christian Church. Born into the riotous upper Egypt of the 3rd century, this boy, always quiet in his comfortable home, would slip away alone into churches and there meditate. When he was approaching 20 years of age he was left an



COURTESY METROPOLITAN MUSEUM OF ART

ST. ANTHONY TORMENTED BY DEMONS

After an engraving by Martin Schongauer (1420?-1488)

orphan, responsible for a sister. Asceticism became his habit and one day he was impressed by Christ's saying, "If thou wilt be perfect, go and sell all thou hast." In disposing of the family property he was about to reserve a portion for his sister, but was restrained by the words, "Take no thought for tomorrow," and he sent the girl to a nunnery. Withdrawing into tombs near the village, he fought with

wild beasts and resisted Satanic temptations in their most alluring disguises. Crossing the Nile, he settled in an old fort at Pisper, now Der-el-Memun and, living on food handed over the wall, did not see the face of man for 20 years. A colony of ascetics gathered in the neighborhood, and when Anthony emerged in 305 he was found to be hale and hearty. For six years he taught and then withdrew to Der Mar Antonios, where he passed 41 years in seclusion, twice visiting Alexandria, however, to encourage the Christians during persecution and to preach against Arius. He died (356?) at the age of 105 years, and his life was written by his friend Athanasius. Lest he provide relics for worship, his grave was kept secret. His cross has no top piece but is T-shaped, like a crutch. In paintings he is accompanied by a wild hog with a bell around its neck, the symbol of a hermit. He was a conspicuous example of simple living and sensible thinking.

**ANTHONY, SUSAN BROWNELL** (1820-1906), American reformer, was born at Adams, Mass., Feb. 15, 1820. She studied at a Friends' school in Philadelphia in 1837-38 and taught school until 1852 when she helped to organize the first woman's temperance society in the state. She was of an assertive and militant type, with an excess of moral zeal, and fearlessly attacked the vices of society. During the Civil War she defended the anti-slavery cause and afterwards campaigned for equal rights for women, especially for suffrage. In 1869, with Mrs. Stanton, she organized the National Woman's Suffrage Association for which she lectured widely and wrote part of a four volume *History of Woman Suffrage*. She died at Rochester, N.Y., Mar. 13, 1906.

**ANTHONY OF PADUA, ST.** (1195-1231), was born in Lisbon in 1195 and baptized Ferdinand. In his veins, according to one account, ran the crusading blood of Bouillon. He became an Augustinian monk but in 1220, seeing the bodies of martyrs brought back from Morocco, joined the Franciscans in order that he might preach to the Saracens. Illness and a shipwreck off Sicily changed his plans and he settled at Montepaolo near Forli. A sudden request for an extempore sermon led to the discovery that here was one of the greatest preachers of all time, and miracles were reported. At the sign of the cross poison inserted in a meal by heretics lost its virulence. A boy, kicking his mother, was so overcome with penitence that he cut off his foot, which Anthony restored. Indignant over the indifference of human audiences, Anthony on one occasion preached to the fishes in the River Brenta near Padua, and as a symbol of his influence over animals he is often accompanied in pictures by a pig. In 1263 his body was removed to the magnificent basilica that has risen at Padua in his honor, and while as a whole the remains had crumbled to dust, the tongue was still a "lively red." Contemporary miracles are associated with the memory of St. Anthony.

**ANTHRACENE**, a coal tar product ( $C_6H_4 \cdot C_2H_2 \cdot C_6H_4$ ) used largely in the manufacture of ALIZARIN

dyes. Anthracene is produced by fractional distillation of coal tar at temperatures of 270°-400°C. The distillate of this process, when cooled, deposits in crystals which are separated from the liquid, yielding a crude anthracene. This product, partially purified by the addition of other coal tar products, is used in the manufacture of alizarin. Anthracene may be further purified to yield a pure anthracene, a clear crystalline substance.

**ANTHRACITE**, the hardest form of COAL, highly valued as a domestic fuel because it burns with almost no soot or dust and burns longer than other types of coal. In America anthracite is often called hard coal, and in Wales culm, or stone coal. It is typically iron black in color, with a surface which may be dull to brilliant. Unlike the BITUMINOUS coals, anthracite does not soil the fingers. It is brittle and is also characterized by its fracture, breaking with a conchoidal or shell-like surface, whereas the bituminous coals break into roughly rectangular fragments. The calorific value of anthracite is lower than that of some good bituminous types because it is slower to develop a high temperature. Little odor is emitted when anthracite burns, and the flame is short, pale blue and smokeless. Some bituminous coal will COKE, but anthracite will not.

All coals are the product of a series of transformations of vegetal matter accumulated, usually in situ, beneath the waters of swamps and bogs, where it forms PEAT and is protected from complete decay. Bacteria and fungi macerate the plant-remains at first, and the weight of later sediments compresses them, driving off some of the moisture and volatile hydro-carbon compounds. Anthracite is produced only when the formations have been subjected to intense strain and compression, developing great heat and pressure within the coal beds. About ten feet of peat remains are required to produce a foot of anthracite. More volatile matter is thus eliminated, and the proportion of "fixed," or non-volatile carbon remaining is increased. The fuel ratio of anthracite lies between 10 and 60. By fuel ratio is meant the percentage of fixed carbon divided by the percentage of volatile matter.

Coal deposits have the shape of sedimentary beds, thin and tabular and of considerable horizontal extent. A bed or "seam" of coal seldom occurs alone, but several are usually present. They may be from a few inches to 100 feet thick. The great anthracite deposits of the world, in America, Europe and Asia, were formed during the Carboniferous age. Over 95% (65 million metric tons) of the world's production of anthracite comes from Pennsylvania. Most of the remaining 5% comes from Wales. There are huge, unexploited reserves in Asia, the largest yet discovered. About two thirds of the anthracite produced in Pennsylvania is used for domestic purposes and nearly a fourth for steam generation. The remainder is used by railroads except for a small amount which is exported. *See also* COAL MINING; JET; LIGNITE.

S. F. K.



**ANTHRAQUINONE**, an important product ( $C_{14}H_8O_2$ ) derived from ANTHRACENE by the action of oxidizing agents. It is also produced synthetically, most of that used in industry being synthetic. Anthraquinone is a yellow crystalline substance which sublimes readily, melts at  $277^{\circ}\text{C}$ . and is readily attacked by reducing agents. Of the various substances prepared from it, ALIZARIN is the most important commercially.

**ANTHRAX**, an acute infectious disease caused by the *Bacillus anthracis*. It is fatal in sheep and cattle, and from them it is transmitted to handlers of wool or hides, though it sometimes results from the use of improperly sterilized new shaving brushes. It occurs in three forms, involving the skin, lungs or intestines. The infection of the skin is the most common form. A rapidly-enlarging pustule appears at the site of the infection, the temperature rises, and collapse follows. When occurring on the skin, absolute rest of the part and the use of antianthrax serum may save the life of the patient. The pulmonary and intestinal forms, though rare, are very severe and rapidly fatal.

**Anthrax in Animals.** Anthrax, which affects both wild and domesticated animals, is found all over the world, especially in countries that have extensive marsh and swamp lands. The infection may come through a wound or through infected food or water. Symptoms differ in the various species and in the internal form death is usually the first sign. In sheep and cattle the animal often tumbles and staggers, there is a rapid pulse and high temperature and frequently blood oozes from the mouth and nose. In the external form, the site of the infection is marked by fulminating carbuncles, which later may appear elsewhere in the body, especially in the lymphatics, the mucous membranes of the tongue and mouth (*Glossanthrax* of cattle) and in the pharynx and larynx of horses and pigs (*Anthrax angina*). The swellings grow rapidly and soon symptoms of a general infection appear. Death usually occurs within a few hours.

**ANTHRAXOLITE**, a coaly, lustrous black mineral sometimes found in veins. It is probably a hard, compressed ASPHALT, and has been mistaken for anthracite COAL because of its combustibility. Under the microscope, however, it shows no vegetal structure such as characterizes coal. Anthraxolite occurs with quartz in veins in slate near Sudbury, Ontario. See also BITUMEN.

**ANTHROPOID APES**, the highest sub-human genera of primates, now usually held to include on the one hand the gibbons of southeastern Asia and, on the other, the three large anthropoids, the orang-utan of Borneo and Sumatra, the gorillas of west and central Equatorial Africa, and the chimpanzees from the same African region. All are arboreal to a greater or lesser degree, and all are confined to the Old World. Like man, and unlike the lower primates (the monkeys and lemuroids), all are without tails. Other characteristics in which they resemble man include

the shape of the pelvis, vertebral column and sternum, the arrangement of the bones and muscles of the arm which permits the palm to be turned uppermost at will, the presence of a long vermiform appendix, the possession of large cerebral hemispheres, and the elaborateness of the convolutions of the brain.

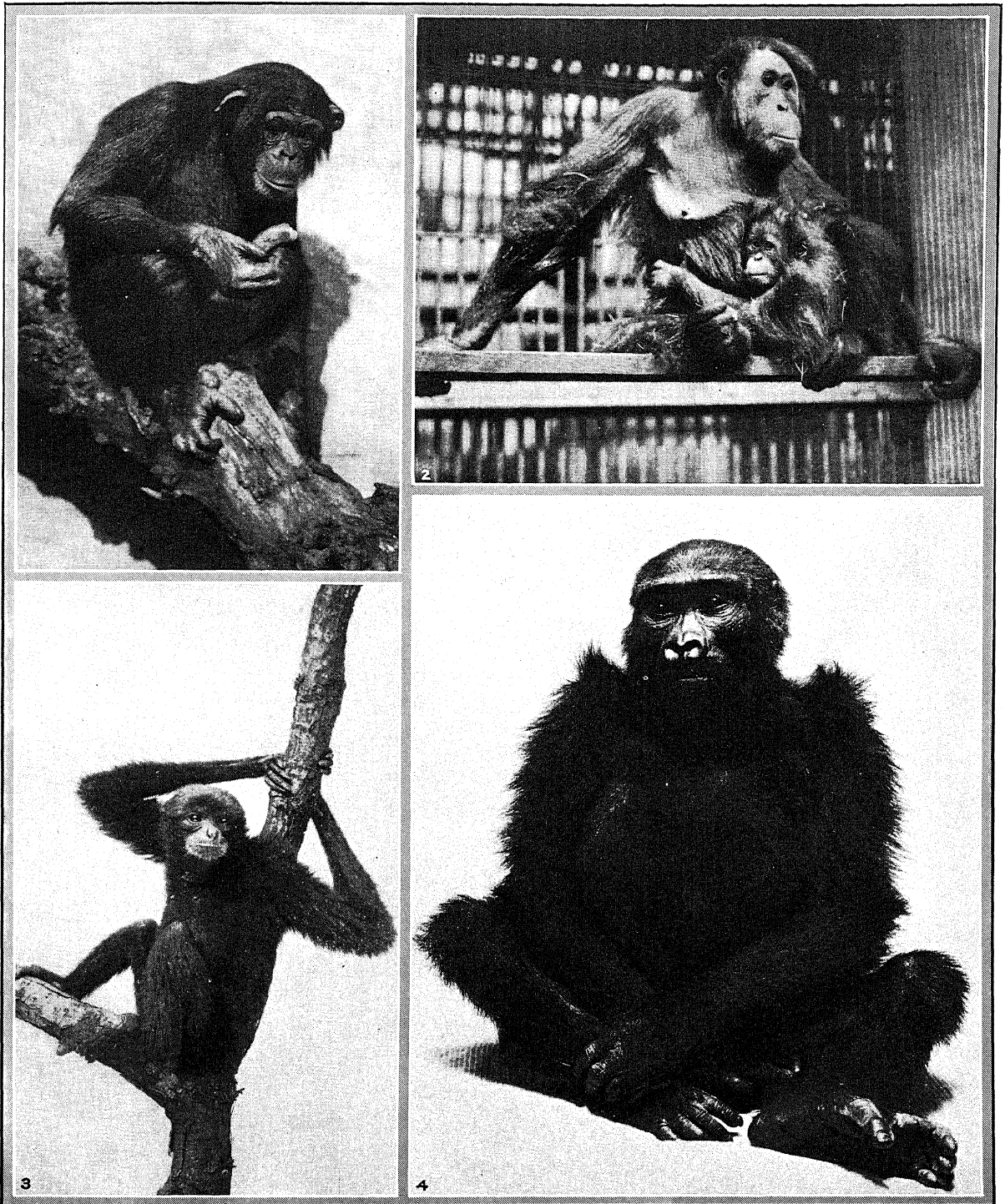
Many of the differences between the anthropoid apes and man depend upon the fact that the apes have remained arboreal, while man has developed a terrestrial habit of life. Man also differs from the apes in having a more delicate hand, a flatter foot, a wider pelvis, a marked sigmoid flexure of the spine, straighter limb bones, shorter arms in proportion to the total height, and a fully erect attitude. Obviously, he lacks the hairy coat of the ape. Another difference, both striking and important, is the relatively small size of the jaw in man in comparison with the relatively great size of the cranium.

Yerkes gives the following arrangement as the probable increasing order for behavioral adaptation with insight: gibbon, orang-utan, gorilla, chimpanzee, but it is to be noted that his gorilla, in captivity, showed considerable insight and memory in solving problems.

**ANTHROPOLOGY** is often defined as the science of man but this definition needs qualification. As used in universities in the United States the word implies the science dealing with the less civilized peoples of the world, or those peoples not treated by historians. Anything, however, which is prehistoric, or which pertains to peoples without writing and so without history, may be considered as falling within the field of anthropology. For example, one turns to anthropology for information concerning uncivilized peoples, like the Eskimo, Bushman or Negrito; again, when historical knowledge fails, as for the Maya of Yucatan, appeal is to the anthropologist. However, this use of the term anthropology is not universal; it is, in fact, limited to English-speaking peoples, since elsewhere in the learned world it applies to the study of man's body only, in contrast to ethnology, the study of customs, speech and related phenomena, one being biological, the other social. In English and American universities and museums the study of race biology and primitive society are combined under one administrative head, in response to which it has become the custom to use the term anthropology as inclusive of all such studies. So, accepting the English usage, anthropology may be said to comprise a number of subdivisions: ethnology, linguistics, archaeology and physical anthropology. These subdivisions will be taken up consecutively, but a brief statement of the history of anthropology may give the background for an understanding of its significance.

While it is true that every civilized people has taken an interest in the uncivilized peoples, anthropology originated among the modern nations of western Europe after the discovery of America and the outlying, uncivilized areas of the Old World. When North and South America came to be comprehended by the great European nations of the 16th century,

## ANTHROPOID APES



1, 2, COURTESY ZOOLOGICAL SOCIETY OF PHILADELPHIA; 3, 4, NEW YORK ZOOLOGICAL SOCIETY

### TYPES OF ANTHROPOID APES

1. Chimpanzee. 2. Sumatran orang-utan and young. 3. Gibbon. 4. Gorilla.



their inhabitants were seen as a mass of pagan peoples to be Christianized. Consequently, missionary and educational activities engaged the attention of the Church and the learned world. Naturally to teach among the pagan one must study the language they speak and at least learn something of their ways of living. Further, those engaging in trade with these pagan peoples, or even in governing them, must also learn about them. Since European nations were at first chiefly concerned with the two Americas, it follows that for a long time the Indian tribes were studied more than any other primitive people. Even to-day it is fair to say that anthropology in America specializes in the study of the Indians and their ancestors.

However, in colonial times Indian languages, Indian customs and beliefs, prehistoric earthworks and other remains came to be recognized as worth while subjects for investigation. Ever confronting the European and colonial mind were questions as to how the Indian reached America and as to what biological and cultural relationships he had to Europeans. Later questions of a similar nature were asked concerning the negroes of Africa, the Australians, Polynesians, etc. Questions in this category are still the main themes in anthropology, though now such questions are asked concerning mankind as a whole. However, it is still true that anthropology is based upon observations made by the European observing the rest of the world.

In part the anthropologist seeks to complete the work of the historian by recovering the history of peoples who left no written records. The early studies of Indians and other primitive peoples soon suggested that human origins and relationships of the past might be approached through observations upon language, bodily features, customs and beliefs, mythology and archaeological remains. It is the hope of modern anthropologists that by checking the data in one of these lines against those of another, they may eventually arrive at an understanding of man's origin and spread over the earth, and further that man may come to know most of the steps by which the present order of society came to be what it is.

The development of anthropology was originally in museums and government departments, rather than in colleges and universities. Scientific museums were, for the most part, devoted to what was then called natural history, presumably history based upon facts of nature rather than upon documents. The natural history of the earth was to be read in the materials of geology, the natural history of life in plants and animals. It was also conceived that man had a natural history dealing with the periods of time preceding the invention of writing. This natural history of man is now known as anthropology.

**The Races of Man.** Certainly the first concern of the anthropologist is with people. All civilized peoples have shown a lively interest not only in their own origin and history but in that of all other peoples. Egyptian artists felt called upon to reproduce

the profile of the Negro, the Semite and the Pygmy upon the walls of temples. From the time of Columbus on, the most popular travel books have included those dealing with adventures among strange peoples. The early Christian church looked upon the barbarian peoples of Europe as closely related to civilized man, and when Columbus and his followers brought to notice many other kinds of savages, these also were considered as descended from the original pair in the Garden of Eden. Further, the weight of scientific opinion has steadfastly favored a single origin for all living mankind; man is regarded as constituting a single species, *Homo sapiens*, and all the living types as divergent varieties of the same. Naturally there have been dissensions, but always emanating from a small minority. Some of the reasons for believing in the single origin theory are that everywhere the mating of the most diverse types of man results in offspring, also fertile; that all men have speech to express ideas; all have conventional habits and customs contrasting with the behavior of other living creatures.

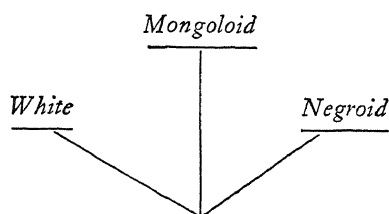
On the other hand, when anthropologists turn to such questions as the place of origin and the circumstances surrounding the differentiation of the known varieties of men, no such unanimity of opinion is found. The reason may be that there are no verifiable facts bearing directly upon these questions. Asia, Europe and Africa each have their champions as the true cradle land, yet the preference seems to be for west-central Asia. The point upon which there is most agreement is that the place of origin was somewhere in the Old World and not in the Americas. This we can accept as wholly consistent with the facts. It follows then that man spread from the Old World into the New and also into Australia and the scattered islands in the Pacific Ocean. So the majority opinion is that the facts lead to two conclusions: first, that modern man belongs to a single main branch of the primate tree and, second, that he originated in the Old World.

Naturally the next questions appealing to us are the circumstances surrounding the branching off of the different races of man and the order and manner of their spread over the Old World and into the New. Limiting the questions to prehistoric time, it becomes clear that the answers must be in the nature of opinions based upon the facts so far accumulated. What one may directly observe and verify are the appearance and bodily form of peoples, the place where they reside, their habits and customs, and their outward behavior. We can also examine buried villages and cities, skeletal remains in graves, etc., and thus recover some of the prehistoric past. For example, all skeletal remains of prehistoric North America so far studied indicate the presence of the general American Indian type, from which it is concluded that this variety of modern man was the first and only important immigrant until Europeans settled here.

Naturally one of the first things to do is to classify living peoples according to their appearance, assum-

ing of course that the characters are such as are transmitted by descent through successive generations. From the first, European observers recognized a few main types which are usually thought of as white, black, yellow, red and brown, the five traditional races of modern man, based for the most part on skin color. Faces seem to be the most distinctive parts of a person, so it is not strange that complexions should be closely regarded. Probably next in order are facial features and hair. In any event, the present-day scientific classification of man takes account of these and other characters, yet departs somewhat from the old notion of five main race types, finding a three-fold division more in keeping with the facts, viz., white (Caucasian), black (Negroid), and yellow-brown (Mongoloid).

These are now considered the three primary races, stems or branches, according to which term one prefers. However, it is recognized that the differences between the Negroids and Mongoloids are greater than the Mongoloids and the whites, which is to say that white and Mongoloid have more in common. For this reason it is assumed that the first break in the homogeneity of modern man was between the Negroid and the ancestors of the white-Mongoloid type. Later on the white and Mongoloid separated.



It should be noted, however, that this concept of three races is a generalization, useful in guiding an inquiry rather than otherwise, for once having this scheme in mind the student can survey man as he is found, noting how far he can be satisfactorily fitted into this scheme.

Before this is attempted, however, another scientific notion should be mentioned, which is that in prehistoric time all mankind was divided into small tribes or social groups, just as uncivilized man still is. These groups, for the most part, marry within themselves, or are inbreeding, forming something like enlarged families. Every one knows that there are such things as family resemblances and, for the same reason, tribes come to have peculiarities of appearance. It is known also that new tribes are formed by splitting off from parent tribes, and again a tribe may absorb a weakened tribe, and other tribes become extinct. If the student gets this picture clearly in mind, he can see in this a situation which must result in many variations in the appearance of people, a situation which scientists have in mind when they say that observation shows that the varieties of peoples so shade into each other that it is often difficult to draw sharp lines in classifications. There is also the tendency of peoples to interbreed, which further compli-

cates the case. The three primary races then stand for three main strains of descent which can be recognized in mankind as a whole. The main distinctions assigned to these three strains are given in the table, a careful reading of which will give the significance of the shading off of these characters, so that, for example, one might find it difficult to distinguish between some Mongoloid and Caucasian faces.

So far the authorities are in close agreement, but the moment one proposes to extend this classification he meets with divergent views, for although many schemes of further classification have been proposed, none of them has been adopted by the majority. The usual method in the end is to treat peoples according to their national, tribal or geographical grouping and, accepting this grouping, to compare the physical character of one such group with another; thus, in selecting the Eskimo, a geographical linguistic unit, it is noted that this people possess striking resemblances to some of the Mongoloids of Asia and also to the American Indians, and, according to the following table of characters, fall into the Mongoloid strain. Further, the general method of dealing with peoples is to think of their homeland first and then their appearance. Knowing their homeland, the feeling is that they are classified fundamentally. Such procedure is equally valid for civilized peoples, as the people of Spain, Holland or Italy.

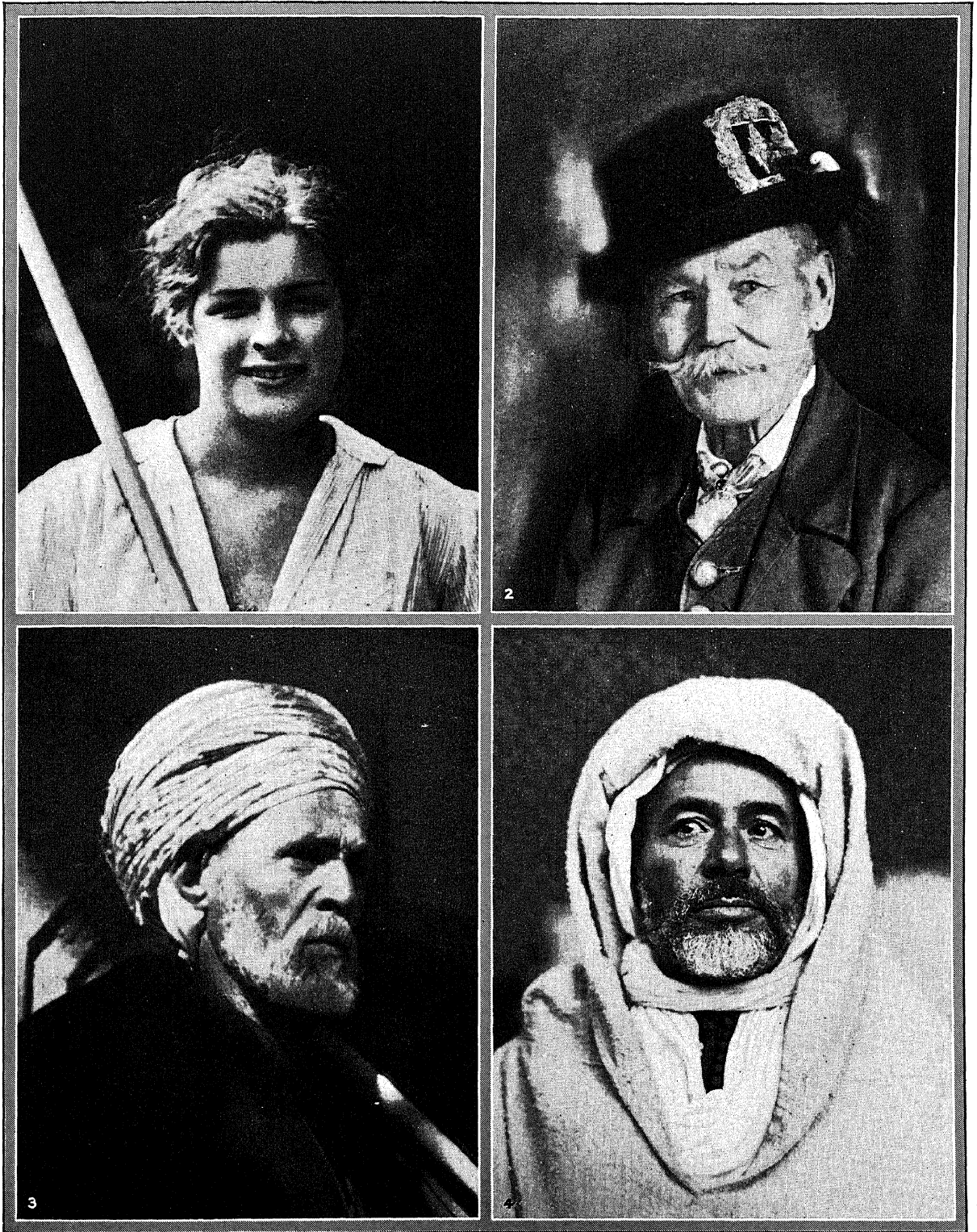
#### PRINCIPAL CHARACTERISTICS OF THE THREE MAIN RACE STRAINS

	<i>Caucasian</i>	<i>Mongoloid</i>	<i>Negroid</i>
Skin	From white to brown	White to dark brown, with a yellowish and sometimes a red cast	Light brown to sooty black
Body hair	Profuse, heavy beards	A trace, beard scant or absent	Usually absent; beards rare
Head hair	Long, wavy to curly; blonde to dark brown, occasionally red	Long, straight and black	Short, bushy, tightly curled tufts; black
Eyes	Large, blue to black, through brown and traces of green	Dark brown to black, eyefold frequent	Large, black
Nose	High, prominent, narrow nostrils pointing forward	Low, moderately wide, sometimes infantile; nostrils oval	Low, large, very wide; nostrils pointing sidewise
Lips	Thin	Full, but not thick	Thick and protruding
Head form	Ranging from long to moderately round	Decidedly round	Decidedly long

**Extinct Races.** Certain finds of skeletal remains associated with bones of extinct animals indicate that modern man was preceded by other types. The best known is the Neanderthal, common in early Europe,



## ANTHROPOLOGY



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### VARIATIONS OF RACIAL TYPE AMONG THE CAUCASIANS

1. Swedish peasant girl of Dalecarlia. 2. Bavarian from Garmisch, in the Bavarian Alps. 3. Syrian priest of the Tomb of Saladin in Damascus. 4. Native Arab of Marrakesh, Morocco.



# ANTHROPOLOGY



1. ANDRE ROOSEVELT PHOTO. FROM R. I. NESMITH AND ASSOCIATES: 2. COWLING PHOTO. FROM EWING GALLOWAY: 3. EWING GALLOWAY PHOTO:  
4. R. I. NESMITH AND ASSOCIATES PHOTO

## VARIATIONS OF RACIAL TYPES IN ASIA

1. Lègong girls, little, specially-trained dancers of the island of Bali, Dutch East Indies. 2. Girl of Darjeeling, India.
3. Women of the Malabar Coast District, India. 4. Mongolian woman of the great Gobi Desert, China.

and traces of this type are reported from North Africa and western Asia. This immediately preceded modern man. Other types more or less commonly accepted are *Pithecanthropus erectus*, Heidelberg man, Piltdown man, Rhodesian man, Peking man. These last are represented by scanty skeletal materials, but there can be little doubt as to their right to be considered as separate species. Little is known of their mode of life because the finds are not associated with camp-sites, implements, etc. On the other hand, the remains of Neanderthal man are associated with the early cultures of the Stone Age, or with chipped implements and fire. Some authorities consider Piltdown man the fabricator of flint implements of simple forms and that Heidelberg man also used stones, but the final proof of this is in the future.

**Ethnology.** Ethnology is the division of modern anthropology dealing with living uncivilized peoples, or such as were in existence in the 16th century. It is thus distinguished from archaeology, which has to do with extinct peoples. It is usual, however, to limit ethnology to the customs and beliefs of mankind rather than to his appearance and speech. In America, to speak of one as an ethnologist implies that he specializes in customs, beliefs, social organization or what constitute tribal cultures, as that term is used by anthropologists. The ethnology of a tribe would thus require full knowledge about their place of abode, their number, their costumes, houses, foods, transport, mechanical arts, form of government, conception of property, marriage, education, war and religion.

However, American anthropologists prefer to group such data under such headings as material culture, social organization, technology, art, mythology and ceremonial organization or religion, the whole constituting an exposition of the culture of the tribe. It may simplify matters if these topics are considered separately.

**Material Culture.** When attempting to describe the life of a tribe it is customary to enumerate all facts concerning such considerations as food, housing, clothing, transportation and utensils under the head of material culture. Everything that is made belongs here. Most of the important foods of modern times were discovered by primitive men. So far as can be ascertained, mankind as a whole prefers a mixed diet of vegetables and animal food. Only in cases of necessity are people found living exclusively upon one or the other. On the other hand, the tendency is to specialize upon two or three types of food. The reason may lie in that special skills and equipment are developed for each type of food, and so it is more economical to confine effort to one or two methods. Thus the Eskimo of America specialized upon seals in winter and caribou in summer; fishing and hunting small game were considered as minor tasks. In harsh environments, like the arid parts of Australia, there is little in the way of large game and vegetation is sparse; in consequence, the Australian natives were observed using almost every variety of animal

and vegetable life they could obtain. In this respect they are about the least specialized of primitive peoples. In contrast there may be cited some Indians of the North American Plains, who lived almost exclusively upon bison flesh.

Primitive agriculturalists usually specialize on one staple, but supplement this with meat when they can. The main cultivated foods have been the cereals, as maize, rice and wheat (including rye, barley, oats). In early times each occupied a different area, as maize in the New World, rice in southeastern Asia, the wheat-like grains in Europe and western Asia. It is a commonplace fact that the early civilizations of the world grew up around cereals. The domestication of animals also was an achievement of Old World primitive peoples and, while these animals were of some importance in transportation, they were mainly a source of food. One of the important problems in anthropology is to collect data upon the origin and spread of all practices relating to the food supply of primitive and prehistoric peoples.

Perhaps after food, tools are the most important of man's possessions; in any event they hold an important place in anthropology. The earliest tools known to modern man are of stone. What, if any, preceded those of stone is a matter of conjecture, since stone is probably the only substance known to early primitive man sufficiently resistant to survive. Early in the old Stone Age bone tools appear. Weapons, which are tools of a special sort, may often have been of wood, but no specimens have come down to us from the Stone Age. The earliest stone tool may well have been a water-worn stone held in the hand, but stone tools are to be recognized only when shaped to perform such functions as cutting, gouging, sawing, perforating and other operations.

Throughout the old Stone Age man shaped his tools by chipping or flaking, seeking such stone as was best adapted to such procedures, viz., materials which under pressure fracture not straight but conchoidal, as flint, chert and obsidian. Chipped tools are found in all parts of the world where suitable materials are available, the fineness of the product varying with the material available, rather than with the state of culture of the workmen. Arrowheads, spearpoints, knives, scrapers, axes and drills are the common form of chipped tools. In the new Stone Age the pecking, abrading and grinding of stone made its appearance. These processes enabled man to make tools of jade, nephrite and other less tough stone which, when finished, could be polished. Most of the stone monuments found in museum collections are of this character, and for these soft as well as hard materials were used, as shell and slate. Presumably most stone tools are merely the blades or points which are hafted in wood and bone handles to form the completed tool.

Many tribes were living in a Stone Age when first discovered by Europeans a few centuries ago, as the Indian tribes of the New World, excepting parts of Mexico, Middle America and the middle Andean re-

gion of South America. Most of the Negro tribes of Africa used iron. Australia, Melanesia, Micronesia and Polynesia were Stone Age areas. In prehistoric times, both in the Old and New worlds, the use of copper was invented and, later on, the making of bronze. Still later iron was largely used among the people of Europe, Africa and the greater part of Asia.

Another line of human invention, almost as fundamental as tools, is that characterized by the making of string and the weaving of textiles. It is difficult to overestimate the importance of the two basic processes, twisting string and weaving. No people of whom there is knowledge to-day were so backward as not to twist string and to know the basic principles of weaving. Matting and basketry seem to be the earlier forms of weaving, but true cloth is also ancient. It appears that every general type of weave now practised was known in some period of prehistoric times and the fibers used were much the same as now. Thus the four classes of natural fibers are hair, bast, cotton and silk. Cotton was used in prehistoric America as well as in the ancient Old World. True flax did not exist in America but certain plants similar to hemp were known. Silk was, of course, peculiar to eastern Asia. Of animal fibers, the list comprises those of the sheep and goat in the Old World and the wool of the llama, alpaca and vicuna in the New. These are the conspicuous examples, but many kinds of hair and bast were used according to the environment in which a particular tribe lived. As to weaves, the main types are plain, quill, coil, pile and tapestry. All are known to prehistoric peoples, the simpler forms being the most widely distributed.

Housing and clothing are found everywhere in some form. Even some crude peoples have brought building to a high level and elaborated costumes. These subjects, also, are treated in detail by anthropologists, including such topics as the building of canoes, mining, tanning, carving and pottery-making. The recording of these processes, their history and distribution, is usually spoken of as technology. With such data before one the evolution of modern technological procedures is often obvious, though rarely can one be sure of the original primitive form of the invention. The wheel, for example, is an appliance of great antiquity in the Old World, but its origin is obscure. The same can be said for the bow and the fire-drill. Further, such appliances as pump-drills and bow-drills suggest the beginnings of modern machinery, and one of the fascinating chapters in this line of anthropological inquiry is to trace out the development of tools and technological appliances.

**Art.** Under the head of art anthropologists consider all efforts at ornamentation and symmetry of form. Chief attention, however, is given to the use of graphic designs and color. The earliest known attempt in such art are the rhythmical markings seen upon bone implements from certain caves in France. Even in these early examples the lines cut into the bone are regularly placed, appearing as the work of a

master hand rather than more or less aimless efforts. A little later, in the Aurignacian Period, appear the simpler efforts at line drawing which culminate in the excellent pictures of the Magdalenian Period. Perhaps the most striking characteristic of the Paleolithic, or old Stone Age, is the ability to draw well.

Turning now to the later Stone Age, the Neolithic, it is first noted that the art preserved to modern times is chiefly in pottery decoration and, as may be expected, is almost wholly in the form of geometric, textile-like designs. There may have been other forms of art, comparable to painting, in the cave period, made upon perishable materials and so lost, but no assumption is warranted as to the character of such art. Because cave men drew pictures with a master hand, and certain primitive peoples like the Bushmen of Africa also drew well, whereas more advanced savages drew less skillfully, but excelled in geometric designs on pottery and textiles, a theory has been offered which assumes that early man drew well and realistically, later to fall into conventionalized, geometric forms. This is probably an unfair assumption, since all people seem to be able to draw well if they become interested. However, it appears probable that the invention of weaving and pottery encouraged the use of geometric designs because such are easier to handle in these processes.

One discovery made by anthropologists was that primitive tribes sometimes regarded their geometric art (designs in weaving, bead work, etc.) as representing living forms, scenic features, and even more or less abstract concepts. This reminded them of what artists had long recognized in the art of the civilized Old World as symbolism, that is, a geometric figure representing a religious object or power. Perhaps the best known example is the Christian cross. The first discoveries of similar symbolism among certain East Indian tribes and again among a few American Indian tribes were received with the enthusiasm usually accorded a new discovery; the assumption was made that all geometric art was, or once was, symbolic. However, as more knowledge came to hand it appeared that the symbolic use of designs was exceptional, yet almost every tribe using such designs recognized one or two, rarely a half dozen, as true symbols. The question as to whether all important designs were once symbolic cannot be answered, but the probabilities are clearly against an affirmative answer. It has been shown that certain types of basketry and matting designs occur in widely separated geographical areas when similar material and weave are used, suggesting that the processes involved led to the independent development of these designs. In such cases there is no ground for assuming that they originated in a symbol. Further, the fact that a primitive tribe assigns a symbolic interpretation to a design does not necessarily mean that the design-form was itself derived from a realistic object, because many instances are known in which the same design is used by different tribes, each ascribing a different meaning.

The understanding of the case is further complicated by the use of pattern names. Designers give names to designs for practical reasons, or so they can talk about them, which names often express a fancied resemblance between a design and an object, as a triangle may be spoken of as a tent. In the same way, wishing to symbolize an idea or a sacred object, a long-used design might be chosen without reference to its origin.

The deep interest of primitive peoples in design and decoration can be observed in any important museum housing anthropological collections. Styles of design and decoration change faster than many other traits of culture and so when found upon imperishable materials, like pottery, assist in the establishment of time-sequence and relationship.

**Mythology.** Long before writing was invented man carried by memory narratives both in prose and in verse. Many of them were regarded as revealing the origin of the world or recounted the deeds and glories of supermen and gods. Others are tales of adventure; some are ethical stories, reciting examples of social or individual injustice, usually righted in the end. Such a body of narratives, preserved among the members of a tribe, is variously designated as folklore, mythology or legends. The tribesmen usually distinguish between myths and narratives of current events. A myth is a story based upon assumed happenings in the remote past, usually in a different world order than now prevails, and in which magical feats are the rule; sometimes such a myth is essentially a hero tale. On the other hand, the natural exploits of men and women now living or recently deceased, and stories of real life, all in natural setting, when well-formulated and known to many tribe members, constitute a body of lore corresponding to the fiction of the present day. Tribe members, clever in delivery and accurate in memory, become the special guardians and narrators of myths and other lore, but rarely do primitive peoples officially designate such persons, or treat them as professionals. To know one's tribal mythology is the duty of every adult, and especially a leader must be versed in it. Since there is no written literature among primitive peoples, what corresponds to a part of present-day education is the learning of mythology. To this end, some effort is made to instruct children, although they hear these tales over and over as they sit with their elders around the evening fire. The aged, who can no longer roam afield, are the chief disseminators of tales among the young. So far as our information goes, primitive children were as eager to hear a story as are those of civilized nations.

Naturally the recording of folklore and mythology is an important part of the anthropologist's job. When he visits a tribe he records either translations of the myths he hears, or takes them down phonetically, to be translated at leisure. He tries to secure all the narratives known to the tribe members, and reference to the literature on the subject will reveal the character, range and volume of tribal lore.

The anthropological study of mythology begins after reasonably complete records have been made for many tribes. Tales spread from tribe to tribe, so the determination of the geographical distribution for specific tales is regarded as important. Although tales may vary in minor details, the essential plot may be found widely distributed. A few such plots known in Asia and Europe are found among many Indian tribes of North America under conditions suggesting their passing to America by way of Alaska, long before the days of Columbus. The example usually cited is the plot known as "the magic flight," which concerns a hero, pursued by a demon or a witch, who escapes by throwing behind him objects which become a mountain, a forest, a lake or other obstacle. While the tale appears in many forms, the outline of the plot is the same. Within a continent, like North America, tales were distributed among the Indian tribes according to geographical areas. Thus a tale about a rolling head was known by most tribes of New England, around the Great Lakes, and well out into the plains west of the Mississippi. Similar distributions of folk tales have been observed in Europe, where the Grimm brothers first pointed out that all Indo-European peoples possessed many myths in common, although the names of the heroes often differed from country to country.

Another problem in folklore is the insight it offers to the life of the people. The folklore of a tribe necessarily contains many specific examples of belief, social ideals and custom. As a rule, when a student takes up the investigation of a tribe he makes a collection of current tales and finds that these are often referred to by tribesmen as sanctions, for example, for certain ethical points of view, theories of the creation of the world, present social practices and ceremonies. Further, some anthropologists believe that since such tales must have been known for a long time, they should show the kind of life that prevailed at an earlier period in the history of the ancestors of these tribes. Thus, although a certain Indian tribe preserves no knowledge of pottery-making, some of the tales they narrate may speak of such vessels. As a rule a tribal mythology deals with the exploits of a few supernatural heroes, of which one tends to dominate. Consequently a number of different tales will present the same hero as the leading character, and not infrequently these tales will be narrated in a fixed order or cycle. A review of these tales shows such heroes performing heroic deeds, swayed by passion, or occasionally stooping to gross immorality.

**Primitive Belief.** In the matter of belief certain assumptions seem to be universal. No tribe has yet been observed which did not assume the existence of an immaterial self as distinguished from the body or the material self. As a rule this idea was extended to include all living and many inanimate objects. Thus a spear might have a soul or spirit as well as material form. This is sometimes spoken of as the belief in souls and when extended to animals and inanimate objects is designated as animism. Further,

all peoples seem to assume the soul, or spirit, to be immortal. Respecting origins, it is assumed that a superhuman power, or a number of such powers, produced the world as man knows it, and that superior beings manifesting these powers can at any time modify the order of nature for good or ill. Hence, when in danger or thwarted in his desires, primitive man beseeches one or more of these powers to intervene. This is seen as the basis of religion in all its forms.

Magic is the name given to beliefs and practices in which a person is assumed to have power over the course of nature. Thus, he may produce rain, cause illness or even death, or he may prevent such happenings. The usual method is to recite a formula, sing a song, or manipulate certain objects. Conjuring is a form of magical procedure. When the interest in magical practices is evil, the term "black magic" is used. Primitive peoples are not devoid of common sense and so do not attempt the impossible or common place, but apply magic to happenings not clearly understood. For example, a wound may be dressed and otherwise treated as a practical matter, whereas an obscure illness which they cannot understand will be assigned to an evilly disposed person or being, to be thwarted by magical procedure. As may be anticipated, the primitive practice of medicine is chiefly a matter of magic.

While, in a primitive community, every person may more or less engage in magic, its practice tends to become specialized, the participant being designated as shaman, medicine-man, charmer, etc. Such professionals have more or less elaborate methods of procedure, which tend to uniformity in each geographical area. Thus in South America the Indian magicians often wear chin whiskers, carry a jaguar skin and use a globular rattle; in Siberia shamans wear special costumes and use hand drums. One important task in anthropology is to describe these procedures as observed among different peoples.

All primitive peoples maintain more or less elaborate ceremonies in which a ritual is demonstrated. By ceremony is usually meant any formalized procedure of a religious or social nature. The theater, which has come to hold a unique place in modern life, has its counterpart in certain aspects of primitive ceremonies, as when the ritual is based upon a mythical account of a supernatural being. For the most part a ceremony can be analyzed and the procedures grouped under the following: 1. an origin myth, recounting the events leading up to the creation of the ritual to be performed; 2. offering and purification practices by the leaders in the ceremony; 3. a series of songs, expressing the concepts involved in the ceremony; 4. dances and evolutions, including impersonations of supernatural beings; and 5. prayers. Thus, such a ceremony offers opportunity for deep religious feeling, for holding the attention of the tribe, for exhibiting the skill of the leader, the skill of participants in dramatic presentation, and the exercise of esthetic enjoyment by all. Anthropologists have given

a great deal of attention to such ritualistic ceremonies, their uses, forms, and distribution among the various tribes. Certain characteristics of such ceremonies have been discovered; for example, the ceremonies of a tribe tend to conform to a single structural pattern and this pattern in turn may spread among the tribes in a geographical area.

TOTEMISM is a form of belief often expressed in ceremonies. In true totemism a *SIB*, or family, regards its name as indicating a family ancestor of supernatural status, who is the guardian of its welfare. If the sib name should be Bear, there will then be a certain body of lore concerning a family bear-god, an ancestor, and more or less elaborate rituals to propitiate the Bear. Totemic ceremonies are especially prominent in Australia. There are also ceremonies among hunting peoples to make the game abundant and easy to capture. Agricultural peoples maintain planting and harvesting ceremonies, and in semi-arid countries rituals are offered to bring rain, as the *SNAKE DANCE* of the Hopi Indians in Arizona. Not infrequently certain ritualistic ceremonies are the function of societies or cults, some of which maintain both secret and public ceremonies.

**Social Organization.** Anthropology gives attention to the social grouping and control among primitive peoples. The family or household appears to be as old as man, but society begins with a sizable group of human beings. Among all primitive peoples there is found the community camp or village. Such a group is rarely large, averaging around 100 individuals, the aged of both sexes, the married and their children. A tribe is an independent or autonomous unit, composed of one or more such community groups. Naturally the sizes of community groups differ, but one rarely meets with a tribe of 3,000 souls; the average seems to be about half that number. It is sometimes said that a tribe is a political organization, a miniature state, whereas the groups that compose a tribe are social organizations. The truth lies in the emphasis rather than in contrasting functions.

The tribal organization recognizes leaders and authorizes procedures of control and defense. This organization is loose and in many respects democratic. Among tribes of simple culture the older and more intellectual men constitute a kind of council which recognizes a spokesman. These councilors represent the community groups, bands or villages comprising the tribe, since each such group is dominated by them. As may be expected, the leadership is that of dominating personalities. Usually tribes consider themselves independent and all other tribes rivals or potential enemies. Unity of speech is the most common tribal distinction, but there is also marked tribal uniformity in most forms of culture. Marriage outside of the tribe is uncommon and so, due to biological relationship, the tribe members resemble each other.

New tribes are formed by the division of older tribes, a condition which often leads to federations.



# ANTHROPOLOGY



1. MAY MOTT-SMITH PHOTO, FROM R. I. NESMITH AND ASSOCIATES; 2. EWING GALLOWAY PHOTO; 3. A. GATTI PHOTO, FROM EWING GALLOWAY;  
4. EARL ROSSMAN PHOTO, FROM EWING GALLOWAY

## RACIAL TYPES AMONG THE NEGROES OF AFRICA

1. Kafir of Rhodesia. 2. Kikuyu woman, British East Africa. 3. Woman witch doctor of Zululand. The charms swung on her neck tell her profession. 4. An Abyssinian, educated by American missionaries of Addis Ababa.





1, 2, COURTESY AMERICAN MUSEUM OF NATURAL HISTORY; 3, COPYRIGHT ROGER DANIELS, NEW YORK; 4, R. I. NESMITH AND ASSOCIATES PHOTO; 5, EARL ROSSMAN PHOTO, FROM EWING GALLOWAY

# NATIVES OF ASIA AND AMERICA

1. Tungus woman of Siberia. 2. Patagonian men. 3. Navajo medicine man of the southwestern United States.
4. Mongolian lama, or priest. 5. Eskimo of Point Barrow, Alaska. 6. A chief of the Blackfoot tribe, Glacier National Park, Montana.

For example, the IROQUOIS of New York were so federated and are spoken of as the SIX NATIONS. On the other hand, weak, unrelated tribes have been observed to be federated with stronger tribes. Such federations are for protection and, in turn, stimulate war and occasionally conquest. The legendary origins of the Grecian and the Roman empires of the Old World and the AZTEC and INCA of the New, conform to the above pattern in that certain tribes federated, later extending their control by conquest.

The tendency in all primitive communities is to hold the parental group responsible for the conduct not only of its children, but of its adult members. Thus, if one member of the community wrongs another, every one related to him by actual or assumed blood descent, is held responsible as against a similar group of relations associated with the injured one. If the contesting persons are from different communities or villages, then each village is responsible, if different tribes, they are responsible. While it is conceivable that adjustments within the tribe might be made by compromise and compensation, intertribal disputes are usually followed by feuds or wars.

Within a tribe one often finds social groupings which have attracted more attention than other social phenomena, probably because they stand in contrast to our own social concepts. Thus, frequently, the individuals in a tribe are assigned by birth to one of two divisions, or moieties, about equal in number. Also the sexes are about equally represented in each. Frequently marriage is regulated by the requirement that one must marry into the other moiety, and not within his or her own. The avoidance of incest has been a concern of all primitive peoples, though they may differ as to what constitutes incest. More or less elaborate systems of classifying individuals are maintained, according to which the avoidance of incest is regulated. These consist of two somewhat complementary social mechanisms, exogamous sibs and systems of designating relationships. In each the individual inherits a class name. The dual division of a tribe into moieties is one simple form of exogamy; the child comes into his moiety by a fixed rule of inheritance, in some tribes through the mother, in others through the father. Since mother and son, brother and sister, are thus members of the same moiety they are barred from marriage. Some tribal societies lack the moieties, but the people are divided into sibs, which are hereditary and exogamous. This system avoids incest equally well. Sibs are spoken of as clans when the child takes the mother's name, and as gentes when the father's sib name is taken. A more complicated system occurs when the moieties are divided into sibs; in such cases one must marry out of his sib, but is further restricted to the sibs of the opposite moiety. Still more complicated systems are found in Australia which restrict exogamous marriage to a single sib.

One of the founders of anthropology, Lewis H. Morgan, was the first to discover that primitive peoples use different methods for reckoning relationship.

In some cases one's mother and her sisters are designated by the same name and no distinction is made between a brother and the male children of a mother's sisters. The principle upon which these systems operate seems to be by generation levels. Since primitive peoples rarely keep a calendar, individual ages are known only in relative terms. Thus an individual will know his generation level, or those with whom he ranked as children. The subject of relationship systems is too complicated to explain fully here; but a general idea of the procedure may be obtained, by noting that among many tribes a single word is used for each female standing in the following relation, for example, to the speaker:

Sister—daughters of my mother.

" —daughters of my mother's sisters.

" —daughters of my father's brothers.

" —daughters of my mother's mother's sisters.

The prohibition against marriage might thus apply to all who bore this class name. It is seen then that these systems of reckoning relationships are arbitrary rather than based upon a true blood relation.

One social distinction upon which humanity seems to place great stress is that between the work of men and women. Whatever a tribe considers the proper work of women is improper for men and the reverse. Nor are peoples in agreement as to the kinds of work assigned to one sex. For example, among American Indian tribes the Hopi men did the weaving, whereas among their Navaho neighbors the women wove. For a Navaho man to weave would be socially absurd, as would it be in the case of a Hopi woman. It appears then that while men and women may be equally fitted for most kinds of work, the social attitude is usually to restrict each kind of work to a single sex.

**Primitive Languages.** The most conspicuous thing about primitive languages is their number. All the important languages of Europe belong to one family, the Indo-European. Around the eastern Mediterranean the Semitic family of languages is found. Turning to the primitive languages of the New World we find a large number of families, North America and South America about 75 each, the total for the remainder of the world being about 29. A family may be composed of many forms of speech, so the number of distinct languages in the world is many times the number of families. In sketching the history of anthropology, the value of language as a basis for the classification of peoples has already been mentioned. It may now be seen that it is largely because of this diversity of primitive speech that it is a useful means of classification when dealing with primitive peoples. Yet it is not only for the sake of classification that primitive languages are studied, but to reveal the characteristics of language in general. Although primitive languages were not reduced to writing they were highly standardized. Also they have extensive vocabularies lending themselves to precise description. Among most tribes the less experienced in tribal and cultural contacts use smaller vocabularies than the experienced.

In the study of a primitive language, the first task is to determine its phonetics and then reduce dictated discourse to writing, making word lists and also texts, as dictated by natives. When sufficient material of this kind has been collected, one may compare lists of common words with those of other tribes, and also grammatical forms; such comparisons will reveal the family to which the language in question belongs, or a new family, as the case may be. The study of primitive languages has practical value also in securing information on the subjects of inquiry in ethnology.

Languages of the same family, as revealed by similarities in vocabulary and in grammatical structure, are believed to have a common origin. Thus, in northeastern United States and eastern Canada most of the native Indian tribes spoke languages of a single family, the ALGONKIAN. Scattered in the plains west of the Mississippi River are a few tribes also speaking languages of this family, as the BLACKFOOT, ARAPAHO and CHEYENNE, and it is usually assumed that these three tribes migrated from the east. While one cannot be certain of this, there is no doubt that they speak an Algonkian language. In short, it is just as important to know the family to which the speech of a tribe belongs, as to know to what botanical family a given plant belongs. Further, such linguistic classification is the only anthropological classification in which a genetic relationship is assumed.

As yet anthropologists have not given much attention to the function of language. Usually one assumes that it is used to convey information, which is obvious, but on the social side it serves to perfect co-operation and control. Further, it is the carrier of experience, which in turn makes culture and ultimately civilization.

Writing is the achievement that tends to take a people out of the hands of the anthropologists and place them in the hands of the historian, but on the contrary the beginnings of writing are given attention by anthropology. It is generally recognized that the earliest forms of writing grow out of the use of pictures and symbols of ideas, or picture writing. Many primitive people were still in this stage when first discovered by white men. One of the next important steps in writing is the representation of sounds by pictures.

Finally, the use of symbols for elementary sounds results in an alphabet. For the history of writing in the Old World one should consult the special books upon the subject. Most primitive peoples use the pictographic form, but rarely attempt to do more than inscribe messages. After contact with civilized peoples they have at times adopted a form of phonetic writing. In the New World the ancient Maya used a form of writing, preserved in inscriptions on monuments. Unfortunately, only the dates in these inscriptions can be read, no other key to this writing having been discovered. At the time America was discovered the only living people making extensive use of writing were the Aztec of Mexico, who used

a mixed phonetic system. Even they depended greatly upon pictures; for example, it is said that the Aztec of the coast at Vera Cruz sent drawings of Cortez and his equipment inland to the capital, where Mexico City now is.

It is evident, therefore, that primitive mankind depended almost wholly upon the memory to carry information and whatever they possessed corresponding to our written literature. Further, writing was usually a specialized art practised by a few individuals, as is still the case, except among modern nations supporting universal education.

**Extinct Races and Cultures.** Almost everywhere on the surface of the earth are evidences of peoples and modes of life no longer existent. In the Mississippi Valley, for example, are mounds and other kinds of earthworks, the builders of which had passed away before the coming of the Indians found there by the first white explorers. Further, scattered over the surface of the earth are to be found arrowheads, stone tools, fragments of pottery, all certain evidence of former residents. The study of such remains and the reconstruction of the modes of life accompanying them is a division of anthropology, designated as archeology. One objective in archeology is to determine time-relations, or relative dates. The most complete time-sequence so far worked out is for western Europe. The main time units are the Paleolithic, Neolithic, Bronze and Iron ages. These are subdivided. The main culture periods in Paleolithic Europe are:

- |                 |                |
|-----------------|----------------|
| 1. Pre-Chellean | 5. Aurignacian |
| 2. Chellean     | 6. Solutrean   |
| 3. Acheulean    | 7. Magdalenian |
| 4. Mousterian   | 8. Azilian     |

This order was determined by the differences in stone implements and other artifacts, together with their positions in the refuse accumulated in the entrances to caves and rock-shelters. If such a site were occupied continuously since man appeared in Europe, the accumulated refuse would contain, in order from top to bottom, objects representing the successive modes of life. A change in the forms of stone implements, for example, would indicate a change in style and such a change is usually accompanied by changes of other kinds. So by noting the positions of the different artifacts in such a deposit, archeologists have agreed upon the eight periods given above. Most of these culture divisions can be subdivided, as upper, middle and lower Aurignacian, etc.

In no other part of the world have the earliest periods of culture been so well worked out, although most of these same types have been observed in Egypt and Asia Minor. In North and South America true Paleolithic cultures seem to be wanting; nevertheless archeologists find evidence of simple nomadic peoples, without pottery. In New Mexico and Arizona the successive periods have been established as follows:

- |                 |            |           |
|-----------------|------------|-----------|
| Basketmaker I   | Pueblo I   | Pueblo IV |
| Basketmaker II  | Pueblo II  | Pueblo V  |
| Basketmaker III | Pueblo III | Pueblo VI |

Basketmaker culture began without agriculture, and without the bow and arrow and without pottery, but the period in which each appeared is known. For example, the bow and pottery in Basketmaker III, agriculture in Basketmaker II. Cotton and domestication of the turkey appear in Pueblo I.

In Mexico and Central America some progress has been made, as placing Maya before Aztec, but the minute chronology is still to be recorded. Yet the search for time-relations is but one of the main objectives in archeology; another is to reconstruct the life of peoples from what remains. A great deal can be done by noting the charred remains of food around a camp-fire, the species of animals represented by the bones cast out, traces of house posts or walls and the kinds of artifacts found. Since very early times mankind began to inter his dead and often placed with them objects used in life. Each group of people tended to uniformity in such practices, so that burials can be classified according to region and also as to type. (*See BURIAL RITES.*) If they are found superimposed, time-relations can be determined. For the archeology of early peoples and their physical anthropology the discovery of burials is of first importance. Further, it is by archeological methods that the gap between anthropology and history is bridged, as in Egypt, Denmark and other countries with prehistoric civilizations.

**Anthropological Points of View.** Naturally anthropology has come to hold certain points of view or principles. In the first place it is assumed that man had a single origin, or that living man belongs to a single zoological species. It would follow from this that his behavior, both physiologically and psychologically, would be generally similar; thus, all use language, invent tools, formulate beliefs, regulate marriage. Further, it is assumed that mankind migrated in groups, gradually spreading over the world, and that other movements have followed, one people forcibly displacing others. It thus becomes important to know as much of the history of mankind as can be recovered, because migrations and changes in habitat and new contacts with peoples are regarded as largely responsible for the culture of a specific people.

The total complex of life of a people, or their culture, is regarded as an accumulation of experience, plus a certain amount of invention. The psychological processes that are assumed to underlie the presence of a new trait of culture are spoken of as invention. Inventions are also considered accumulations, since one mechanical principle may combine with others, as observed in any modern complex mechanism.

Another concept is that any culture is prone to change; it does not remain at one level. The rates of change may vary, but culture change is always present. Such changes are regarded as due to individual inventions and changing environment. Everywhere human beings are seeking to control conditions and in many instances to improve them; they observe the

ways of other peoples and tend to imitate or to adopt what seems novel or better. In this way culture is borrowed or, as anthropologists say, it is diffused from one people to another. Diffusion is regarded as explaining the presence of culture elements among several peoples; thus, the use of telephones by many peoples and nations is an example of diffusion.

Modern anthropology puts store upon the geographical distribution of culture traits, regarding such distributions as caused by borrowing or diffusion. For example, before the discovery of the New World, the cultivation of maize was universal over a large part of North and South America, but not known in the Old World. It is assumed, therefore, that the cultivation of the plant originated somewhere in the New World and its cultivation and use spread by diffusion. If a trait of culture is found spread continuously over an area and not found elsewhere, its origin is sought within that area.

Finally, note may be taken of a theory, entertained by some anthropologists, that no trait of culture is ever invented twice. From this it would follow that no matter where in the world people are found doing the same thing, using similar tools, building stone walls, walking on stilts, etc., they must have borrowed the idea and the method from others. The majority of anthropologists, however, reject this extreme view, preferring to decide each case according to the evidence available.

**Fieldwork.** Expeditions or, properly, visits to the less civilized peoples to observe their customs and their anatomy, are to an anthropologist what a laboratory is to a biologist. It is true that he may study collections in a museum, but unless these were collected by him or by another trained anthropologist they are of little service; in other words, an anthropologist must make his studies first hand. The advance of anthropology since 1870 is largely due to the improvements observable in the methods used in such field study. The thorough study of a living tribe requires that their language be reduced to writing and dictated texts recorded, that all phases of their daily life be recorded under the headings discussed above, and finally that a sufficient number of individuals be measured to determine the anatomical type. Both still and motion photography are now employed to show many phases of life. The phonograph is extensively used to record the music of the tribe, but is not regarded as sufficiently accurate to record speech.

The archeologist obviously searches the surface of the earth for evidences of prehistoric occupation and excavates in promising sites. In the main, he seeks out the geographical distribution of each type of artifact and also looks for stratigraphic or superposition data from which he may infer time differences.

Until recently the only American institutions supporting anthropological fieldwork were museums and special State and national bureaus, but now a number of universities also support such work under the auspices of their departments of anthropology. The

total number of institutions engaged in anthropological research, among the civilized countries of the world, is about as large as in other fields of learning, as distinguished from applied sciences. C. W.

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**ANTHROPOLOGY, CRIMINAL.** See CRIMINAL ANTHROPOLOGY.

**ANTHROPOLOGY, PHYSICAL.** In the hierarchy of the sciences physical anthropology might properly be regarded as a branch of biology, but in textbooks and university curricula it is more usually associated with ethnology and archeology. The reason for this lies in its historical development and in the interest in man which it shares with ethnology and archeology. Physical anthropology ambitiously claims to be the science of man, but other fields of investigation also have a legitimate share in man which are not included within the strict limits of physical anthropology. Another definition is, therefore, sometimes employed; namely, the Natural History of Man. This may be accepted as adequate if natural history be taken to embrace the evolution of man, his differentiation into races and types, his growth phenomena, his miscegenation, his heredity and the variations of his physical traits. This last, indeed, really constitutes the essential study of the science. To classify and arrange the physical variations of man into a coherent system and to discover the mechanism operating to produce them is, in fact, the not inconsiderable burden of physical anthropology.

**History.** Leaving aside the omniscient Greeks, to whom all things are traced, physical anthropology owes its origin as an organized branch of knowledge to the impetus imparted by the revival of anatomy in the 16th century. Thus Vesalius (1513-64), a pioneer anatomist, also became one of the fathers of physical anthropology. As early as 1684, Bernier first proposed a fourfold division of mankind. Fifteen years later, Tyson, an Englishman, published a classic work on the comparative anatomy of man and anthropoids. The anatomy of Tyson's day was purely descriptive. But the introduction of the comparative method infused new life into sterile facts, and the comparative anatomy of the primates, a branch of physical anthropology, was born. Tyson demonstrated a series of similarities and divergencies, remarkable in those times, between man and the primates, but their implications bore little philosophical fruit. They did, however, open a new field in which countless new facts were to be garnered and later endowed with significance.

Linnaeus (1707-78) also contributed to the definition of the content of physical anthropology. He is important in this respect mainly because he regarded man as an animal, and because he included the human species in his classificatory system of nature based on zoological criteria. To a generation accustomed to regard man as an integral part of nature, it is difficult

to value properly the advance which Linnaeus's conception of man represented. In man's intellectual history a concept may be as fruitful as a fact.

Coeval with Linnaeus, Buffon (1707-88), in France, who ranged widely over the field of natural history, described much that related to man. According to Buffon, humankind consisted of six races. Aside from his voluminous descriptive writings, Buffon is also remembered as a forerunner of Lamarck. Still another important figure in these early racial studies was John Hunter (1728-93). An investigator of renown, he published in 1775 a racial classification of man in which he attempted to define more closely the idea of species. Hunter believed that all the races of man were derived by the operation of environment from a single stock.

Under the influence of Blumenbach (1752-1840), physical anthropology took enormous strides towards a clear-cut methodology. Blumenbach went to the actual crania for his observations and produced a series of papers on the characteristics of various races. He enlarged the number of racial criteria to include, beside skin color and stature, hair and eye color, cranial form, face, teeth, body proportions, sex characters and form of hand and foot. Although his material was scanty and his resources inadequate, Blumenbach stimulated investigations similar to his own. Another early contributor to the technique of physical anthropology was Peter Camper (1722-89), who discovered the facial angle as a diagnostic trait for the classification of man. Toward the middle of the last century, the Swedish anthropologist, Anders Retzius, introduced the cephalic index which exerted a profound influence, not entirely salutary, on subsequent studies. Only recently has this tool been questioned as the touchstone of racial classificatory problems.

With the advent of Darwin's *Origin of Species* in 1859 and *Descent of Man* in 1871, physical anthropology took a new lease of life. (See DARWIN, CHARLES.) At least, a practical framework was provided upon which the results of research on man could be arranged. One cannot overestimate the significance of the evolutionary doctrine in the development of physical anthropology.

Starting with Galton in the latter part of the 19th century and continuing with Pearson and his disciples, physical anthropology has been enriched by the addition of statistical methods. Pearson's biometrics have been of invaluable service in reducing the great unwieldy bulk of measurements to convenient and negotiable constants.

During the 19th century in France one might mention among the distinguished students of physical anthropology Paul Broca, Topinard and de Quatrefages, while in Germany, Virchow, Vogt and Kollmann contributed important studies. Of the more recent distinguished figures one may name Martin, Fischer, Mollison, Sergi, Manouvrier, Boule, Keith, Hrdlicka and Hooton.

**Classification of Primates.** Man's place in nature as one of the primates is now well established.



He shares with other members of this order prehensile limbs terminating in five digits, opposable first digits, complex brain structure, large clavicle, large eyes directed forward, reduced face, a similar dental formula, and a common type of placenta. The precipitin blood reaction test of Friedenthal confirms the close relationship of man and anthropoids. Systematists have divided the order of primates into the following families.

1. *Lemuroidea*, small squirrel-like arboreal animals, found principally in Madagascar, and less commonly in Africa and India.

2. *Tarsioidea*, represented by one living genus, the *Tarsius*. This creature is small, nocturnal and lives in Borneo and the Philippines.

3. *Hapalidae* are found in the New World. They are commonly known as marmosets.

4. *Cebidae*. "New World monkeys" or Platyrrhini. The common hand-organ monkey belongs to this group.

5. *Cercopithecidae*, *Catarrhini* or "Old World monkeys." Found principally in Borneo and Africa. The members of this group are pronograde and terrestrial. The baboon is a well-known representative of this family.

6. *Simiidae* are the tailless large apes and include the gorilla and chimpanzee found in Africa and the orang and gibbon in Asia.

7. *Homo*.

**Evolution of Man.** Evolution as a working hypothesis is so abundantly documented that no biologist hesitates to accept its truth. (See EVOLUTION.) It is, however, when one comes to depict the successive stages in the evolution of an organism and the mode of its operation that the great schism becomes apparent. To put it briefly, there are those who agree with Darwin that the fortuitous combinations of chance variations can account for the progression from amoeba to man; and the others who stress the rôle of adaptation and of use and disuse. But in that direction lies controversy.

Among the general problems facing the physical anthropologist, the process of human evolution is outstanding. One can only summarize here the dominant schools of thought. There is, of course, no doubt that the immediate ancestors of man are to be found among the primates. According to the more generally accepted view man's lineage may be traced back to a primitive generalized mammal that took to an arboreal existence. Probably through an insectivore stage this precursor developed into a primitive primate. In the eocene this stock had become a definite simian type which gave rise to platyrrhine monkeys, common in the New World, and the catarrhine monkeys found in the Old World. From a common catarrhine type the line advanced to an anthropoid type from which arose, on the one hand, the gorillas, chimpanzees, oranges and gibbons and, on the other, man.

A dissident hypothesis, championed by Wood Jones, dispenses with the intervening anthropoid stages in the evolution of man. The argument is brilliantly

expounded in *Arboreal Man* and rests largely on the principle of convergent evolution.

The arboreal existence of man's immediate ancestors played a controlling part in his development. It was in the leafy school of the trees that the precursor of man was graduated from a primitive and generalized mammalian structure to an upright posture with all the correlated changes which are associated with this mode of progression. The brachiating form of progression, imposed by arboreal life, was the controlling factor in the acquisition of the typically human erect posture. During this stage a significant development of the brain occurred. Elliot Smith has described the growth of the neopallium which was consequent to the replacement of the dominance of smell by that of hearing and sight.

**Fossil Man.** The actual birthplace of man has never been discovered, although considerable discussion has been aroused over this point. Mathews and Osborn represent one faction which places the cradle of homo in central Asia. The recent find of *Sinanthropus* near Peiping has done much to bolster up this view. But going back to Darwin there has been a belief that man originated in Africa. Recently Hooton has defended this hypothesis. Ameghino's argument that man developed in South America has been exploded with the discrediting of his fossil finds.

The first human fossil find to excite widespread interest in scientific circles was made by Buckland in the Paviland Cave in 1822. To his discovery he gave a Biblical interpretation in harmony with the spirit of the age. The uncovering, at about the same time, both in England and on the Continent, of artifacts associated with extinct fauna led to the enthusiastic exploration of a great number of caves. In 1833 Schmerling found a human skull at Engis, near Liège, in 1844 Aymard discovered human remains at Denise (Haute Loire), and in 1856 the since famous Neanderthal skull was unearthed by Fuhlrott in the valley of the Neander in Germany. These early finds were discredited and violent controversy raged over their authenticity as veritable relics of paleolithic man. Even so distinguished a scientist as Virchow attempted to refute the antiquity of the Neanderthal skull. The accumulating evidence, however, became too strong to doubt any longer, and, with the general acceptance of evolution, these fossil remains of man's early history fell into their proper place.

The most primitive of the rapidly increasing fossil record are *Pithecanthropus erectus*, discovered at Trinil, Java, and announced by Dubois in 1894; and the recent find near Peiping of a related form, named *Sinanthropus*. *Pithecanthropus* is referred to the late pliocene, while *Sinanthropus* has been assigned to an early pleistocene horizon. The cranial capacity of *Pithecanthropus* is midway between the larger anthropoids and primitive modern man. *Sinanthropus*, discovered by Mr. Pei, has been described by Davidson Black as showing evidence of closer relationship with *Pithecanthropus* than any other fossil hominid, but of the two types Black considers *Sinanthropus* as repre-



senting a more generalized form and as exhibiting sufficient dissimilarities to warrant a separate generic classification. For a more complete account of man's fossil record the reader is referred to PREHISTORIC MAN.

**Races of Man.** The classification of humanity into races has been one of the historic problems of physical anthropology. Race as used by the physical anthropologist is a finer subdivision of a species. As defined by Hooton, a race "is a great division of mankind, the members of which, though individually varying, are characterized as a group by a certain combination of morphological and metrical features, principally non-adaptive, which have been derived from their common descent." Some students distinguish further between primary races, or those moulded by the operation of evolution on its inherent traits, and secondary races, which are the resultants of ancient and stabilized mixtures between two or more primary races. The number of racial criteria have been constantly expanded from the time of Linnaeus. The older writers sought for a single diagnostic character whose variations might supply sufficient categories into which the races of man would fit. These efforts have not only proved abortive, but they distort the evidence itself. The specific character of a race lies in its peculiar combination of a number of individual traits any one of which may exist in another combination in other races. (See RACES OF MAN for description of racial criteria and racial classification.) The origin of races is a moot point. To the environmentalist differences between races arose from responses to environmental stimuli. Thus the dark pigmentation of the Negro is the direct result of exposure to the actinic rays of the sun. There are difficulties in the way of accepting such an hypothesis. But neither is the opposite view that races evolved from chance variations entirely acceptable. Geographical isolation is, however, an important factor in both hypotheses.

A large measure of the difficulties confronting a racial analysis of many populations arises from the fact that mixture has been widespread over a long period of time. This condition of affairs makes it rare to find ideal representatives of pure races. Consequently a race is frequently only a convenient abstraction which is rarely found completely typified by its members.

Race studies have been effected by examination of skulls (see CRANIOLOGY), of skeletons (see OSTEOLOGY), and by measurements on living subjects (see ANTHROPOMETRY).

**Race Mixtures.** From the time when races first became distinct entities, opportunities for mixture undoubtedly occurred. Throughout the world large sections of mankind are composed of ancient and more or less extensive mixtures, which have developed varying degrees of homogeneity. But superimposed on these stabilized populations are to be found new mixtures, largely the result of recent population movements. In most cases these offspring of mixed origin form a distinct class, although wherever the prejudice is slight they tend to amalgamate with the original

stocks. The inheritance of racial traits in these mixed populations has been a fruitful field of research in the last two decades. Investigations have been carried out among the Hottentot-Boer crosses, the mulattoes of Jamaica, the Indian-Spanish crosses in Yucatan, and the Polynesian-White hybrids. The offspring of these mixed marriages tend to create a mosaic of their ancestral traits, although in later generations the original strains are approximated by a certain percentage of the hybrids.

**Population.** The recent investigations into the behavior of population units are a natural corollary to the study of race. Workers such as Pearl have attempted to establish the sigmoid curve to express the growth of populations. Pearl claims that the normal increase of a population starts by a gradual gathering of momentum. After a period of slow growth the curve rapidly mounts during a period of marked increase. Finally it gradually loses momentum and ends in a barely perceptible gradient, so that the tail of the curve approximates its beginning.

As a result of population studies the concept of an optimum as opposed to a maximum population has influenced thinking along these lines. Students recognize that a point in population rise may be reached beyond which further increase is not beneficial. The effect of population density on birth rate and death rate is of profound significance, but, unfortunately, as yet little understood.

Population decline has been studied in Oceania where the phenomenon is particularly striking. Rivers suggested psychological factors as operating powerfully to bring about this depopulation, but other investigators stress socio-economic conditions and sex-ratios.

In most normal groups the sex-ratio is fairly even. But in Europe as a result of the war the female preponderance is very great. It is well known, too, that older communities tend to have a higher proportion of females than newer settlements.

Man's increasing release from the confines of his natural environment has inevitably created a series of problems of population adjustment. Only tentatively are these realized and efforts made to understand the nature of the resultant effects on human economy.

**Criminal Anthropology.** Is there a well-defined criminal type which can be recognized by physical stigmata? On the answer to this question, it is obvious penological practice hinges. If we have born criminals in our midst, it is clearly a question of the segregation of such individuals and the elimination of their potential breeding. On the other hand, if criminality is a purely sociological expression unrelated to heritable traits, we can adopt a program of prevention. The importance of the issue is clear. Lombroso, an Italian, in the latter part of the 19th century, attempted to prove the existence of a criminal type stigmatized by a number of physical traits. He regarded the criminal as an atavism reminiscent of primitive man. In 1913, Charles Goring published *The English Convict* in which he refuted Lombroso's findings. In this work, the criminal type is denied. Goring insists that

the physical differences of the criminal from the general population are correlated with his smaller stature, lesser weight, and defective intelligence. Neither does Goring admit the association of sociological conditions and crime. Recently the whole problem has been reopened by Hooton who has carried out an ambitious project on the criminals of the United States, involving the examination and measurement of upwards of 20,000 convicts. See CRIMINAL ANTHROPOLOGY.

**Constitution and Endocrines.** The association of disease with physical type has attracted considerable attention. The idea is an old one that man can be divided into a number of types according to gross body characteristics. The respiratory, the cerebral, the sanguine are only a few of the traditional classifications. Since 1910, however, a great mass of literature has appeared in which correlations have been attempted between specific types of body build and disease. The greatest activity in this field has been in Germany. Kretschmer has classified types into the athletic, asthenic and pyknic. He found, for example, that the pyknic (short, broad habitus) is rather more inclined to the manic-depressive form of insanity than is the asthenic (narrow, lean) which, on the contrary, showed a higher proportion of schizophrenia. In the United States, Draper found a correlation of incidence of such diseases as gastric ulcers, nephritis, pernicious anemia, and gall bladder with body build. His clearest association was of gastric ulcer with asthenics and of gall bladder disease with pyknics.

The influence of the endocrine glands on body build is well known. The forms of giantism resulting from an over-functioning pituitary, the dwarf-like cretins, and the corpulent sufferers from an under-functioning pituitary are but a few of the many obvious results of endocrine disfunction. These discoveries led Keith to speculate on the endocrine origin of racial differences. We are, however, no nearer a well-based conception of the relation of race to endocrines.

**Age Changes.** The characteristics of growth phenomena have proven a rich field for research. Growth may be studied in two ways. The older method consisted of measuring the living subject directly. This involved the use of calipers or tape on a large number of subjects ranged according to age or on a fewer number of subjects repeatedly measured during the course of a specified time. With the perfection of roentgenology, it is now possible to measure the bony structure from x-ray pictures, so that structures formerly invisible are now subjected to a measuring stick. Aside from quantitative changes during growth, a number of qualitative changes have also been studied. Minute analyses have been made on the bodily changes occurring from the foetus to old age. The most obvious change which the new-born infant undergoes during its growth is the decrease in relative size of the head and trunk and the proportionate increase in limb length. It has been observed that growth is accelerated at certain stages during infancy and childhood. The greatest spurt comes at puberty which is somewhat earlier in girls than in boys. See GROWTH.

**Other Fields of Investigation.** It is impossible within the compass of this article to do more than indicate the scope of physical anthropology. In addition to some of the major fields of physical anthropology mentioned above, there are a number of additional problems engaging the interest of students in this science. Only a few can be listed.

The stability of physical type is a fundamental question which inevitably affects the philosophy not only of the physical anthropologist, but also of the student of world movements. Boas two decades ago called attention to the fact that the descendants of immigrants to the United States showed small but consistent changes. Hrdlicka, also, has pointed out the emergence of a distinctive American type. The defect in these inquiries was the absence of control groups of the parental population still living in the original environment.

Data have been accumulating from various sources, indicating that economic conditions are effective in inducing changes in physical type. The famine conditions in Russia during the World War resulted in marked changes in stature and head diameters. Social classes within the same population have been found to differ in physical measurements. The upper strata are taller and heavier. Better dietary and hygienic conditions are probably responsible for this superiority.

A constant increase during the course of the last century in the average stature has also been noted. As much as two or three inches have been added to the mean height for some groups. In Japan the average for stature has also increased during the past twenty years.

The correlation of race and intelligence has been the subject of much investigation consequent upon the development of a method of testing intelligence. Standardized intelligence tests have been applied to a number of different races and groups. As yet, there have been no completely satisfactory correlations of race and intelligence.

Finally, one may mention the serological studies of Landsteiner which have had an important bearing on race studies. Human blood was found classifiable into four groups depending on the agglutinative reaction of their corpuscles to various sera. It has been found that the percentages of these groups present in various populations differ profoundly. See BLOOD-GROUPING. H. L. S.

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**ANTHROPOMETRY.** The technique of measuring the human body is known as anthropometry. The word itself is derived from the Greek roots of *anthropos*, man, and *metron*, measure. Included in the field of physical anthropology, it is applied, in a strict sense, only to the measurement of the living.

The science of measuring bones, on the contrary, is designated as *osteometry*, and that of the skull as *cranimetry*.

Although any one who measures the stature of an individual is by way of being an anthropometrist, this science is said to have been initiated and stimulated by the researches of Charles White (1728-1813) who stated that the fore-arm in relation to the upper arm is longer in Negroes than in whites. This observation was based on exact measurement and marked a long step from subjective judgment to the precision of objective measurement. In effect much of the succeeding work has been an expansion and refinement of White's method. Just as physical anthropology is preoccupied with concept of variation in man, anthropometry is a method of expressing that fundamental tendency of all organisms. In much of the early work in anthropometry racial differences were the principal object of investigation, but in recent years it has been put to other and more varied uses. In growth studies anthropometry is an invaluable technique. Also modern studies on constitutional differences are very largely dependent on the *modus operandi* afforded by anthropometry.

Measurements in anthropometry are taken at termini which correspond to anatomical landmarks. These points are determined by palpation. The definition of the various landmarks in use was standardized by the International Congress of Anthropologists meeting at Monaco in 1906 and at Geneva in 1912. These meetings were called in an effort to eliminate the wide discrepancies in the technique of various workers. It is obviously of considerable importance in comparative work that all investigations be carried out in a strictly standardized fashion. There are two accepted ways of measuring the human body. One is by direct measurement from one landmark to another. The other is called the projective method and consists of taking a series of measurements on the same side and from a constant plane. The distance between any two points is obtained by subtraction which gives the desired measurements.

The accuracy of measuring a living body varies with the skill of the operator as well as the degree of control that can be exercised on the subject. The body reclining on a horizontal plane is much less subject to the slight and constant shifting in position that characterizes the standing subject. For various reasons, however, it is impractical and sometimes impossible to measure adults in a reclining position. Consequently the majority of the anthropometrists are accustomed to measure standing subjects.

Although many objections have been advanced against the technique, it remains the most useful one and at present the only one that can be successfully used in the field.

The instruments most commonly employed in anthropometry are the anthropometer, sliding and spreading calipers, and tape measure. The anthropometer is a rod usually of metal and about two meters high. Two arms, one of which is adjusted to

slide up and down the rod itself, are attached to the instrument. Both the rod and the arms are calibrated ordinarily in the metric system. Stature and the larger dimensions of the body are obtained by means of the anthropometer. The calipers, however, are most frequently employed in measuring the head and face. Girth measurements are secured with a tape.

Part of the technique of anthropometry involves the taking of observations which are not subject to exact measurement. The number of such possible observations is very large, but include such things as hair, form and color, skin color, eye color, eye folds, classifications of various characteristics of the nose, mouth, chin and forehead. For some of these traits published diagrams and scales are in common use, but in all observations of this kind there is a large subjective element in the judgments of the observer.

H. L. S.

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**ANTHROPOMORPHISM**, a term of Greek origin, used to signify the tendency of the human mind to conceive the activities of the external world in the images of human activity. It has found expression in most religious beliefs, especially in respect to the deity, and has been justified on the ground that truth can only be conveyed through the medium of human ideas. To conceive God "walking in the garden of Eden" is anthropomorphic. The Syrian sect of the Anthropomorphites arose in the 4th century, believing God to have a human form, but after being accepted by a few African Christians, disappeared long ago.

**ANTIBES**, a fortified seaport in the department of the Alpes Maritimes, France, beautifully situated on the Mediterranean, 8 mi. northeast of Cannes. In the city hall are Gallic Roman remains. Fruit, olives, grapes and tobacco are grown. The nearby Cape of Antibes is a fashionable winter resort. Originally Antibes was a Greek colony of Massilia (Marseilles) and was called Antipolis. Later it flourished as a Roman municipality on account of its fisheries and trade in tunny and salted fish. Remains of a Roman theater, an aqueduct and many other relics of antiquity exist. At the end of the 9th century, the seaport was destroyed by the Saracens and came into the possession of the counts of Provence. The bishopric which had existed since the 5th century was transferred to Grasse in 1244. Napoleon I landed at Antibes Mar. 1, 1815 on his return from Elba. Pop. 1931, 26,071.

**ANTICATHODE**, that body in a vacuum tube (see TUBES, ELECTRONIC) opposite the CATHODE, toward or against which the cathode discharge is directed. In some cases, as in the more simple forms of X-RAY tubes, the ANODE is made to serve also as an anticathode. In high power x-ray tubes, because of the intense heating effect of the cathode rays on the anvil upon which they strike, the anticathode must be of massive tungsten or similar heat-resisting material, and it often requires special arrangements for cooling. In

the x-ray tube the anticathode is the source of the x-rays.

**ANTI-CHRIST**, a personification of evil. The term, evidently familiar at the time, occurs in St. John's Epistles (1:2:18, 22; 4: 3) and with it may be compared St. Paul's "man of sin" (II Thessalonians 2: 3-8). The idea appears in Daniel (7: 25) and Anti-Christ, whether Jewish or Christian, has been identified by speculative scholarship with Antiochus Epiphanes who persecuted the Jews and plundered the temple, and with Roman emperors so dreaded as Nero and Caligula. The expectation that a struggle between good and evil will usher in the end of the world may be traced in the Book of Daniel, in Christ's prophecies (Matthew 24) and in the Book of Revelation or Apocalypse.

**ANTICIPATION**, in music, the sounding of one or more tones in advance of the chord they actually belong to, is the opposite of **SUSPENSION**. The following simple instance of anticipation will serve to illustrate the general principle:



It is a device much used by composers of the classical period.

**ANTI-CLERICALISM** may be defined as opposition to the political influence of the clergy, more specifically the Roman Catholic clergy. It marks the modern phase of the historic struggle for ascendancy between Church and State and has assumed great importance in the Latin countries of Europe, as well as in Mexico. In 1877 GAMBETTA expressed the attitude of French Liberalism in his famous phrase: "*Le clericalisme, voilà l'ennemi!*" Within 30 years the schools had been laicized, the religious orders dissolved and the church disestablished. In Italy the conflict has been ended, apparently, by the agreements of 1929 which, besides restoring the temporal power of the pope, authorize religious instruction in the schools and make the Roman Catholic religion the sole religion of the state.

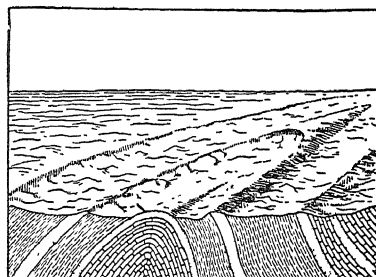
E. M. S.

**BIBLIOGRAPHY**.—C. H. Hayes, *Political and Social History of Modern Europe*, 1924.

**ANTICLINE**, a bowed up or arched structure sometimes noted in **SEDIMENTARY ROCKS** and old **LAVA** flows. When sedimentary strata are subjected to compression by movements in the earth's crust, they are wrinkled into folds which may be from a few inches to miles across. The up-arched parts are called anticlines, and the down-warped ones **SYNCLINES**. Anticlines form an excellent trap and reservoir for **PETROLEUM** deposits. Such folded structures in the deeper portions of the crust may die out and show no evidence at the surface of their existence. See **GEOLOGY**.

**ANTICOSTI ISLAND**, a maritime province of Quebec, Canada, lying in the Gulf of St. Lawrence

at the mouth of the St. Lawrence River. Its length from east to west is 135 mi. and its extreme width 30 mi. The interior is overgrown with dwarf-spruce forests which are a refuge for valuable fur-bearing



FROM WILLIS, *GEOLOGIC STRUCTURES*, MCGRAW-HILL

ANTICLINE SHOWING THE OUTCROP ON THE SURFACE AND A VERTICAL CROSS SECTION

animals. In 1896 Anticosti was made into a game preserve by M. Menier, a French confectioner, to whom it had been leased. Later it came into possession of the Anticosti Pulp and Paper Corporation. Four lighthouses are maintained on the island to protect vessels from its dangerous coasts. The population of about 250 is chiefly composed of lighthouse keepers and their families.

**ANTICYCLONE**, an atmospheric disturbance characterized by high barometric pressure over a limited area, and outward-flowing winds. At its center the anticyclone is marked by calm, clear, dry weather, the days being warm in summer and in winter often intensely cold. In temperate regions anticyclones, or "highs," travel from west to east. See also **CYCLONE**.

**ANTIDOTES**, remedies for poisoning, may act by (1) evacuating the poison from the stomach or bowels, (2) converting the poison chemically into a less harmful substance, (3) counteracting the physiologic effects of the poison upon the system.

The choice of antidote depends upon the type of poison which has been taken. Some poisons irritate the surfaces with which they come into contact: the mouth, esophagus, and stomach; others act after absorption into the body by either exciting or depressing the nervous system or the circulatory system.

Certain irritant or corrosive poisons (such as *carbolic acid*, *bichloride of mercury*) should be first rendered less irritant by quickly giving white of egg, milk, flour and water, or oil in large quantities. The stomach should then be emptied as soon and as completely as possible by administering mustard and water or by tickling the inside of the throat with the finger, or test by washing the stomach after passing a stomach tube.

At times it is possible to neutralize the poison chemically: if the poison is an *acid*, one should use a weak alkali, as lime-water, magnesia, powdered chalk or soap and water. If the poison is an *alkali* (as *ammonia*, *lye*, or *potash*), a dilute acid, such as vinegar

or lemon juice, should be used. Large quantities of these antidotes are needed, as they are used up by chemical action. Oils should never be used for any poison containing phosphorus, as matches or rat poison.

Tannic acid is the most useful general antidote for drugs poisonous because of their action after absorption. This substance should be followed by an emetic. Persons having convulsions, excitement, delirium, rapid heart and breathing (e.g., in cases of *strychnine* poisoning), should be given a sedative, as potassium bromide, chloral, or other drug inducing sleep and then have the stomach washed out. On the other hand, in cases of narcotic poisoning (such as *opium*, *chloral*, *veronal*, *aconite*, *belladonna*), the victim should be given an emetic and stimulants until the doctor arrives.

For *iodine* poisoning, starch and water should be given. For *formaldehyde*, soothing drinks, milk and oils.

In all cases, a physician should be called immediately, and antidotes should be given while awaiting his arrival. The order of treatment is: (1) Dilute the poison; (2) remove it from the stomach; (3) repair or counteract its effects by drugs of opposite action, protectives to the stomach, rest. *See also* TOXICOLOGY. B.F.

**ANTIETAM, BATTLE OF**, Sept. 17, 1862, an engagement of the CIVIL WAR resulting in a disastrous defeat of the Confederate army. Gen. McClellan with a Union force of 75,316 troops attacked Gen. Lee's army of 51,844, occupying a strong position on Antietam Creek, near Sharpsburg, Md. After a sanguinary all-day contest, both sides ceased fighting. Although McClellan had lost 12,469 men, the advantage rested with the Federal army. Lee had lost ground, and the casualties, 13,533 men, totaled more than one-fourth of his army. When McClellan failed to renew the battle on the following day, Lee, abandoning his invasion of Maryland, retreated across the Potomac. At the news of this victory, President Lincoln issued the EMANCIPATION PROCLAMATION.

**ANTIFEBRINE**. *See* ACETANILIDE.

**ANTI-FEDERALISTS**, those who opposed the adoption of the Constitution of the United States, 1787-89. Richard Henry Lee, James Monroe, George Clinton and William Lowndes were prominent Anti-Federalists committed to extreme States Rights doctrines, and fearful that the proposed Federal Government would endanger state interests and prerogatives. Luther Martin of Maryland represented the sentiment in small states that representation in the House of Representatives according to population was an unacceptable limitation. Other leaders resented the prohibition of the issuance of currency by the states. The Anti-Federalists probably would have prevented the ratification of the Constitution if it had not been agreed that a BILL OF RIGHTS should be added.

**ANTI-FREEZE SUBSTANCES**, chemical substances, both organic and inorganic, which are used to lower the freezing point of water. The inorganic

group includes calcium chloride, sodium chloride and other salts. These salts are corrosive in contact with metals and are therefore unsatisfactory. The organic anti-freeze compounds are chemically neutral and non-corrosive, and are non-conductors of electricity. This group includes denatured ethyl alcohol (*see* ETHANOL; ALCOHOL, INDUSTRIAL), METHANOL (wood alcohol), GLYCERINE and ethylene glycol (*see* GLYCOLS). Automotive equipment manufacturers recommend only the above-mentioned organic anti-freeze substances for use in the cooling systems of their cars.

Denatured alcohol and methanol are inexpensive, but because of their low boiling points they are soon lost by evaporation, necessitating frequent replacement to maintain adequate protection against freezing. Also, alcohol solutions and vapors are injurious to lacquer finishes. Ethylene glycol and glycerine, on the other hand, have much higher boiling points than water and are, therefore, not lost by evaporation. Glycerine and ethylene glycol are harmless to lacquer finishes; the latter has the further advantage of circulating freely at low temperatures. J.G.D.

**ANTI-FRICTION METALS**. *See* BABBITT METAL.

**ANTIGO**, a city in northern Wisconsin, the county seat of Langlade Co., situated on Spring Brook, 32 mi. northeast of Wausau. The Chicago and North Western Railroad serves the city, which is an important shipping center for potatoes, small grain, and dairy products. Antigo has cheese, veneer, shoe last, tie plug and other factories. The city is located on the watershed between the Mississippi and the St. Lawrence rivers. The countryside is attractive, abounding in small lakes and trout brooks. The Menominee Indian Reservation is 10 mi. to the east. Antigo was founded about 1882 and chartered in 1885. Pop. 1920, 8,451; 1930, 8,610.

**ANTIGONE**. *See* OEDIPUS.

**ANTIGONIDS**, a Macedonian dynasty, founded by Antigonus Cyclops, so called because he had lost the sight of one eye. Antigonus, like Ptolemy, had been a general in Alexander's army. After the death of Alexander, in 323 B.C., Antigonus tried to establish himself in Macedonia and also in Asia. With a varied fortune the line held power at intervals between the death of Alexander and the Roman conquest of Macedonia. Antigonus I was killed at Ipsus in 301 B.C., when his forces were overpowered by the combined strength of Seleucus, Lysimachus and Cassander. His son, Demetrius I, called Poliorcetes (337-283 B.C.) succeeded him. Demetrius had helped his father establish himself in Asia Minor but after the Battle of Ipsus, he turned his attention to Athens. Sailing with 250 ships he gained possession of the city and was hailed as a savior. But this triumph was short-lived, and the Athenians later turned against him. Taken a prisoner in 286 B.C. by the forces of Ptolemy, Lysimachus and Pyrrhus, he remained a captive for the last three years of his life, despite the efforts of his son Antigonus II (c. 319-239 B.C.) to free him. The latter's reign covered the period in which the

Gauls were repelled and witnessed the Pyrrhic Wars. Antigonus Gonatas was followed by his son Demetrius II, who reigned between 239 and 229 B.C. He was disturbed by the encroachments of the AETOLIAN LEAGUE and ACHAEAN LEAGUE upon his power; but neither Macedonian nor Greek efforts were able to stave off the Roman power. It was during the reign of Philip V, 221-179 B.C., that the Romans gained their victory at Cynoscephalae in 197 B.C., and with it the power of the Antigonids soon crumbled.

**ANTIGUA**, officially Antigua Guatemala, a city of GUATEMALA situated in a valley at the base of the volcano of Agua, about 27 mi. southwest of Guatemala City. It is the center of the coffee-growing region. Until 1773 capital of the republic, the city was wrecked by an earthquake, and the administration was removed to the city of GUATEMALA. Interesting ruins of old churches and monasteries are found here. Pop. 40,000.

**ANTIGUA**, an island of the West Indies, one of the five presidencies constituting the British colony of the LEEWARD ISLANDS. It is somewhat circular in form, has a length of 20 mi. and an area of 108 sq. mi. The surface is uneven and the climate dry. The major products of Antigua are cotton, sugar and pineapples. St. John, est. pop. 7,000, is the chief town. The islands of BARBUDA and REDONDA, which have a combined area of 62 sq. mi., are included in the presidency of Antigua, which is itself the capital of the Leeward group of islands. Antigua, one of the West Indies sighted by Columbus in 1493, was settled by the British in 1632. Pop. 1931, 30,909, including Barbuda.

**ANTI-IMPERIALISTS**, a group of Americans who opposed the imperialistic policies of the United States growing out of the Spanish-American War. In 1898, before the treaty of peace was signed, they formed a league the purpose of which was to oppose the dominion of the United States over other peoples. The activities of the league have been chiefly directed toward criticism of American administration in the Philippines. The criticisms of the anti-imperialists have made for a large measure of self-government among the Filipinos. In the years immediately following the Spanish War the Anti-Imperialists were notably influential in New England.

**ANTI-KNOCK COMPOUNDS**, substances which, when present in small amounts during combustion in gasoline or Otto-cycle engines, prevent the knock. Examples of anti-knock compounds are tetra-ethyl lead, tetra-ethyl tin, dimethyl cadmium, di-ethyl selenide, di-ethyl telluride, iron carbonyl, nickel carbonyl, tri-ethyl stibine, tri-ethyl arsine, iodine, and aniline. Of these, tetra-ethyl lead is used commercially as the active anti-knock compound of the "ethyl" gasolines which are produced by a large number of refiners in the United States and foreign countries.

Knock is a disturbance in the gasoline engine which usually occurs when a car is being accelerated from a low speed or when it is lugging up a hill, and which manifests itself as a "pinking" or metallic noise. The

composition of the fuel is the principal one of the several factors which determine whether knock will occur. Other important influencing factors are the temperature and the degree of compression of the charge, and the timing of the spark. Unless the fuel and engine conditions are such as to produce knock in the absence of an anti-knock compound, its presence has no apparent effect upon the way the charge burns. Being present only in very small amounts, anti-knock compounds do not appreciably change such characteristics of a gasoline as its volatility or its energy content.

Of the anti-knock compounds mentioned above, tetra-ethyl lead is one of the most effective and aniline one of the least effective, aniline being only about one-fiftieth as effective as tetra-ethyl lead. One tenth of one per cent tetra-ethyl lead by volume is equivalent to about 40 per cent benzene by volume when each is added to a conventional gasoline, benzene being considered not as an anti-knock compound, but simply as a fuel which is relatively free from tendency to knock. Both the absolute and the relative effectiveness of anti-knock compounds vary quite widely, however, depending upon such factors as the fuel in which the effect is exerted and the mixture ratio in which the effect is measured.

For the effect on health of the vapors of such compounds, see GASES AND ATMOSPHERES, INJURIOUS.

T. A. B.

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**ANTILLES**, an alternative name for the West Indies, excluding the Bahamas. The more extensive group, known as the Greater Antilles, comprise CUBA, HAITI, JAMAICA, PORTO RICO and scattered islands in this northern division of the Antilles. The Lesser Antilles describe an arc to the southeast of Haiti and comprise chiefly the LEEWARD ISLANDS, WINDWARD ISLANDS and small clusters between these two, extending as far as the northeast coast of Venezuela.

**ANTILOGARITHM**, the number which corresponds to a given logarithm; that is, if  $\log 3 = 0.4771$ , then 0.4771 is the logarithm and 3 is the antilogarithm. We can find from a table of logarithms that  $\log 70 = 1.8451$  (to the nearest thousandth). We then speak of 70 as the antilogarithm of 1.8451. More generally, if  $\log a = n$ , then  $a$  is the antilogarithm of  $n$ . We express this by the equation  $\text{antilog } n = a$ . See LOGARITHMS.

**ANTI-MASONIC PARTY**, an American party organized in 1827-28 as a result of the widespread excitement following the abduction of William Morgan, a citizen of western New York who had threatened an exposure of the secrets of Freemasonry, and the recovery of his body from Lake Erie. The party's leading principles were hostility to the Masonic order and the exclusion of its members from office; but several discontented groups introduced other issues, notably, in 1830, opposition to President Jackson. Having attained successes in New York State politics,



the party attempted to form a national organization, and in 1832 nominated William Wirt for the presidency, but carried only one state, Vermont. After 1832 many Anti-Masons cooperated with the opponents of Andrew Jackson in forming the WHIG PARTY.

**ANTI-MILITARISM** assumes a variety of forms. In its broader aspect it reflects the aspiration towards international peace and finds expression in the cause of disarmament. For a decade the LEAGUE OF NATIONS has been preoccupied with this problem; and early in 1931 the Preparatory Commission having formulated a draft treaty for the LIMITATION OF ARMAMENTS—all nations were invited to participate in a conference to meet in Feb. 1932. In its narrower aspect anti-militarism implies hostility to the professional soldier, who is accused of exerting a reactionary influence in politics and of instigating imperialistic adventures. It has manifested itself particularly in France. There in the early years of the Third Republic army officers were suspected of monarchistic sympathies; later on the pacificism of Socialists and Radical-Socialists (see SOCIALIST PARTY) renewed the agitation against the army. E. M. S.

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**ANTI-MONOPOLY PARTY**, a political party organized at Chicago, May 14, 1884, by a convention of friends of economic reform. BENJAMIN F. BUTLER, who bolted the Democratic national convention of that year, was nominated for president on a platform demanding an interstate commerce law, popular election of United States senators, free trade, and the prohibition of land grants to railroads and other corporations. When Butler accepted also the nomination of the GREENBACK LABOR PARTY, the Anti-monopoly party lost its separate identity.

**ANTIMONY**, a lustrous silvery, crystalline, brittle metal (symbol Sb, at. wt. 121.76) which occurs naturally both as a free metal and in metallic sulphides. It is found chiefly in stibnite, being separated from it by melting the stibnite with iron which combines with the sulphur. Antimony readily forms alloys with many metals and some of these are of great importance to industry because of their property of expanding upon solidification. TYPE METAL, stereotype metal and BRITANNIA METAL are antimony alloys which form sharp castings as a result of their expansion upon cooling. Antimony melts at a low temperature (630° C.); it unites directly with the halogens; does not rust, but will burn when heated in air, forming antimony trioxide.

**ANTI-NEBRASKA DEMOCRATS**, members of the Democratic party who opposed the opening to slavery of territory made free by the MISSOURI COMPROMISE. (See KANSAS-NEBRASKA BILL.) Their strength in Congress in 1854 was about half of the Democratic representation from the northern states. Ultimately most of these became Republicans.

**ANTINOMIANS**, in colonial Massachusetts, adherents of certain religious theories disallowed by the Puritan majority. The name (coined by Martin

Luther, signifying "those above and adverse to the law or Mosaic code") was attached derogatively to the followers of ANNE HUTCHINSON, who believed in grace through inner consciousness; that is, that those who were not conscious of the presence of the Holy Ghost within them were doomed. John Wheelwright, an Antinomian banished from Massachusetts Bay Colony for "sedition," founded the town of Exeter, N.H. Most of the Antinomians followed Mrs. Hutchinson, who was banished for "traducing the ministers and the ministry," into exile. See RHODE ISLAND, *History*.

**ANTINOMY**, a contradiction in reason both sides of which may be proved logically. The term is closely associated with Kant's famous antinomies of pure reason. (See KANT, IMMANUEL). He set up a thesis and proved it, whereupon he set up its antithesis and proved this with equal success. Thus it is possible to show that the world must have had a beginning in time and is limited in space, and equally possible to show that it could not have had such a beginning in time and must be infinite in space.

**ANTIOCH**, the most important city of several with this name, situated in Syria, in the fertile valley of the Orontes River, about 20 mi. from the Mediterranean Sea. It was founded about 300 B.C. by Seleucus Nicator, and named for his father, Antiochus. Antioch became the seat of government for the Hellenistic kings of Syria. The plan of the city was like that of Alexandria. Three later rulers added to the city until it comprised four distinct quarters with separate walls. It was a city of great luxury and often called "The Queen of the East." Daphne, a resort noted for its loose morality, was only 4 mi. away, and Antioch acquired a similar reputation. It fell to Rome in 64 B.C., and was chosen as the capital of the eastern emperor. The Romans further beautified it and Olympic games were held there under Commodus. The population rose in the 4th century to about 400,000 and it was the center of the trade from the east. The city was a stronghold of the early Christian Church and the seat of many of its councils. Antioch was the starting point for the missionary journeys of St. Paul and it was there that the name Christians was first used. The city suffered from frequent earthquakes, and was destroyed twice by the Saracens. Justinian rebuilt it in the 6th century, but the Saracens got possession in 638. The Crusaders held it from 1098 to 1268 when the Turks retook it. Since 1920 France has held it under a mandate.

The modern town covers only a part of the old city and is badly built. The valley in which the city lies is rich in the production of grain, cotton, tobacco and fruit, for which Antioch is the point of distribution. Silk worms are produced, and soap, shoes and cutlery are manufactured. The city has numerous mosques, bazaars and some Christian churches. Pop. 1929, 28,000.

**ANTIOCH, SIEGE OF.** On Oct. 21, 1097, during the First Crusade, siege was laid to Antioch, a city

much too well fortified to be stormed by the means available to the westerners. The city was not even blockaded until February and then not completely. The besiegers themselves suffered seriously from want and were harassed by attacks from the neighboring Turkish emirs. A large army from Mosul under Kerboga was approaching to raise the siege when Bohemund gained entrance to Antioch by treachery, June 4, 1098. The crusaders themselves were then besieged within the city and were so straitened for supplies that they had to fight. In this crisis the discovery of the head of the lance alleged to have pierced Christ on the cross inspired the crusaders with hope and zeal. Their desperate fanaticism coupled with the skilful leadership of Bohemund enabled the Christians to inflict a crushing defeat on Kerboga, June 28, leaving them in possession of the city. See CRUSADES.

**ANTIOCH COLLEGE**, a coeducational college, situated at Yellow Springs, O. It was founded in 1853 with HORACE MANN as its first president, 1853-59, and reorganized in 1921 by Pres. ARTHUR E. MORGAN. Since its reorganization, Antioch has attempted to combine a liberal education, vocational training and an actual apprenticeship to life. Students devote half their time to study during their five- or six-year courses. The other half they devote to actual work in factories or offices, working as regular employees in 15 states under 175 different employers. Under a system initiated in 1928, students are thrown almost entirely upon their own responsibility after they become sophomores. In 1931-32 the college enrolled 585 students, and had a teaching staff of 80 members, headed by Pres. Arthur E. Morgan. The productive funds in 1931 were \$275,363. The library contains 36,524 volumes.

**ANTIOCHUS**, the name of 13 kings of the Seleucid dynasty (see SELEUCIDS) ruling in Syria and neighboring provinces from the death of Alexander the Great until the conquest of Syria by Rome, 323-64 B.C. The most famous of them was Antiochus III the Great, 223-187 B.C., who by successful wars in Asia Minor and Egypt extended his empire, only to lose most of what he had gained when the Romans under SCIPIO AFRICANUS defeated him at Magnesia. Antiochus IV Epiphanes by an attempt to suppress Judaism provoked a revolt among the Jews. The kings of an affiliated dynasty, 698 B.C.-72 A.D., also were named Antiochus.

**ANTIOPE**. See AMPHION.

**ANTIPIRETICS**, remedies capable of reducing fever temperature. They may act by increasing heat loss, by depressing the heat-regulating center of the body, by quieting heat-producing vital activities, or, finally, by killing the organisms causing the fever.

In fever, the heat-regulating center of the brain is thrown out of adjustment and is erratic in action. Coal-tar antipyretics, as antipyrine, are able to depress this now unstable center and bring about a reduction of temperature. Temperature is lowered through increased radiation from the surface, which is effected

by sweating and reddening of the skin; and at the same time heat-producing vital functions are reduced. Excess of this action leads to acute collapse. Thus the use of these substances is not without danger.

Furthermore, reduction of fever without removing the cause is dangerous in itself. For fever is a warning signal of a more serious condition. The elevated temperature, furthermore, is indeed useful to the body, as it makes conditions unfavorable for invading organisms, and aids in elaboration of immunizing substances. Antipyretic measures, even including cold bathing, are now merely employed to keep the temperature from becoming too high and therefore harmful; while the coal-tar antipyretics are chiefly useful in reducing the aches and pains of the fever patient. In malarial fever, quinine not only acts as antipyretic but it also has a special effect in helping the system in the destruction of the invading microparasites. B. F.

**ANTIPYRINE**, official name for phenyl-dimethyl-pyrazolon,  $C_9HON_2(CH_3)_2.C_6H_5$ , a synthetic drug in the form of a crystalline powder, colorless, almost odorless, which acts somewhat like acetanilide. Also known as Phenazone, and is derived from phenylhydrazin. Its chief use is as an antipyretic and to relieve pain other than that caused by inflammation. However, it is not a safe ingredient of preparations sold to the public.

**ANTIQUARY, THE**, the third of the WAVERLEY NOVELS, by SIR WALTER SCOTT; published 1816. The scene of the novel is the northeastern coast of Scotland, about 1795. The book opens with Jonathan Oldbuck, the eccentric antiquary who gives the story its title, receiving young William Lovel at Monkbarrow, his curious estate. The chief incidents of the rather rambling plot are a treasure hunt carried on by Oldbuck and his neighbor, Sir Arthur Wardour, and Lovel's winning, after an arduous courtship, of Miss Wardour.

**ANTI-RENT PARTY**, in New York State, the political manifestation of an agitation to abolish the semi-feudal features of land tenure in the state, irksome survivals of the era of the Patroons. Farms in the older counties were mostly leased, in perpetuity or for a period of two or three lives, with ground rents paid in kind, and certain feudal dues exacted in case of transfer or other contingencies. Attempts to collect from remiss tenants created several violent disturbances, 1839-45. The Anti-Rent party, appearing in 1842, gained control of several counties, and in 1846 elected its candidate for governor, John Young, nominally Whig. In 1846 an article was inserted in the State Constitution abolishing all feudal tenures.

**ANTI-SALOON LEAGUE OF AMERICA**, a federation of state leagues which was organized in 1895 to promote the cause of PROHIBITION and which was chiefly instrumental in securing 25 years later the adoption of the 18th amendment. The League sought first of all to create a favorable public opinion, and to that end it employed every resource of publicity and spent colossal sums (for a time \$2,500,000 a year) in distributing literature and hiring speakers. Next it

brought pressure to bear on the state legislatures. In 1913, having conquered, state by state, almost three-fourths of the whole area of the country, it launched the drive for an amendment to the Federal constitution. Its energies are now directed towards enforcement of the prohibition law.

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**ANTISANA**, a volcano of the Andes in Ecuador, 35 mi. southeast of Quito. It rises to a height of 19,335 ft., and was ascended in 1880 by Edward Whymper, the British explorer. The town of Tambo de Antisana is on the slope of the mountain at an elevation of 13,000 ft., one of the highest settlements in the world.

**ANTI-SEMITISM**, a word first employed in 1880 in Germany to express opposition to the social and political rights and the equality of the Jews, whose Semitic origin was thus thrown into relief. Later it manifested itself in the form of economic boycotts; the exclusion of the Jews from universities or the strict limitation of their numbers there, the so-called *numerus clausus*; or in the form of actual political and civic disabilities and discriminations, as in Poland and Rumania at the present time. The utterly false and mistaken view that the Jews as Semites, as members of the Semitic branch of the white race, are an inferior and unassimilable group, may have provided the prime motive for the rise of anti-Semitism. Envy of the high financial position attained by a small handful of Jews, regardless of the fact that the overwhelming masses of Jews in all countries of the world in which they dwell lived in want, poverty, or at best in modest circumstances, was undoubtedly a second factor in its rise and spread. A third factor, and by no means the least important, was resentment on the part of the Christian Church and some of the Christian clergy of the fact that the Jews preferred to remain Jews, and stoutly resisted or remained utterly indifferent to, all attempts to convert them to Christianity.

In its proper and limited sense the term anti-Semitism is to be applied exclusively to movements undertaken against the Jews in comparatively modern times, from about the year 1880 to the present. A wider but less accurate view of anti-Semitism would include all persecutions suffered by the Jews at all times, beginning with the attempt of Haman to destroy them, as recorded in the book of Esther, and all hostile displays of feeling, all legislation enacted against them as adherents of a different religion or as a people who claimed to have a peculiar mission in life and to be a separate and a better nation. Thus the Greeks and Romans practiced this form of hatred of the Jews, or Judophobia, hating and despising them because of these claims of superiority or of being a "peculiar people." During the Middle Ages Judophobia was carried on against them chiefly because they persisted in remaining Jews although the economic motive likewise entered into play. The civic

emancipation of the Jews and the granting to them of full religious equality before the law in France, Germany and other countries of Europe between 1789, when the French Revolution occurred, and 1878, when the Congress of Berlin was held, were also opposed by the enemies of the Jews both on economic and religious grounds. By this time, however, the liberal principle of freedom of religious belief had come to dominate almost the whole of Europe, so that the term anti-Semitism became henceforth restricted to those who opposed the basic maxim of all modern states, i.e. the civic and political equality of all the inhabitants of a country, irrespective of color, race, religion or nationality.

To-day anti-Semitism in several of the countries of Europe, as in Poland and Rumania, still retains all the features of the movement in the past; political persecution, physical attacks on Jews, insistence on the observance of a *numerus clausus* in colleges and universities, the social exclusion of the Jews, fierce discrimination against them unless they accept baptism, economic boycotting, and exclusion of Jews from civil, governmental, industrial, commercial, academic and military positions. In the United States, where a mild form of anti-Semitism shows itself in certain sections from time to time, it takes merely the form of social boycotting and the exclusion of Jews from various colleges and various social institutions by certain groups of the population. There is also an amount of religious discrimination, but this is utterly frowned upon by the great lay and clerical leaders of the various Christian churches. In addition, there is also, in certain sections of the country, some economic discrimination on the part of small groups of the general population, but not enough of all forms of anti-Semitism in general to prevent the social, economic, religious and political life of the Jews of the United States and their personal freedom and safety from being infinitely superior to that prevailing in any other countries of the world, with the exception of England, Italy and France. The latter are renowned for their liberalism towards all religions and nationalities, and for their almost absolute lack of anything savoring of anti-Semitism and religious discrimination.

A. SH.

BIBLIOGRAPHY.—Lazare, *Contre L'Antisémitisme*, 1896; Lee Levinger, *Anti-Semitism in the United States*, 1925.

**ANTISEPTICS**, agents capable of preventing bacterial growth but not necessarily destroying bacteria. While conditions remain the same, the antiseptic action may persist, but if conditions are altered, such as by the dilution or addition of organic matter, bacteria may resume growth. The term is almost universally applied by the laity to signify a substance that kills bacteria (germicide). The U. S. Food, Drug, and Insecticide Administration has ruled that the term as used on packages in interstate commerce must denote germicidal action, not merely antiseptic action. (See also DISINFECTANTS.)

**ANTISPASMODICS**, remedies used for the control or relief of muscular spasms or cramps. They

form a heterogeneous group of therapeutic agents, as there is quite a variety of muscular spasms, which must be treated in different ways.

All the sedatives acting on the central nervous system function as antispasmodics. (See SEDATIVES.) General anesthetics are, of course, especially potent antispasmodics, but they are resorted to only in severe major convulsions.

Internal spasms, as the colic of infants or uterine colic of menstruating women, may often be controlled by much milder means. Various aromatics as fennel, peppermint, catnip, and pennyroyal, administered in the form of hot teas, are in order here. The heat with its muscle-relaxing quality is one of the chief sources for efficiency of these. Indeed, their internal use is well combined with the external application of heat. However, as far as intestinal colic is concerned, the mildly irritant action of the volatile oil also favors the expulsion of the gas responsible for the colic.

Closely allied in action are certain substances of extremely offensive taste and odor, such as asafetida or valerian. These drugs have been used since antiquity to combat hysterical convulsive seizures. In addition to aiding in reestablishment of normal control by acting as a mild stimulant to the brain, the recall of their unpleasant features may go far to prevent another attack.

Belladonna and its derivative, atropine, are of great value in relaxing spasms of involuntary muscles by a depressant effect on sympathetic nerve endings in these muscles (see NERVES; NERVOUS SYSTEM). These drugs have unpleasant side-actions, however, which interfere with their desirability as antispasmodics. (See ATROPINE.)

ADRENALIN and EPHEDRINE, through stimulation of sympathetic nerve endings, cause relaxation of bronchial muscles in asthma. B. F.

**ANTITHESIS**, balancing contrasted words or ideas against one another to emphasize the contrast, i.e., "fair but foul." The effect can be heightened by alliteration in the most important words or phrases that are contrasted. Single words, phrases, clauses, or even extended passages can thus be set off against each other. Antithesis is used more sparingly to-day than in former times, since it can easily lead to a ponderous and artificial style and a straining of the truth; but if sparingly employed, it can be very effective.

**BIBLIOGRAPHY.**—A. Bain, *English Composition and Rhetoric*, 1872; J. F. Genung, *The Practical Elements of Rhetoric*, 1902.

**ANTITOXIN**, any substance in the animal or human body which acts against a poisonous substance, which results normally or may be developed in the body. In the treatment of various infectious diseases, antitoxins, prepared by injecting toxin into the blood of animals and permitting the animals to develop anti-substances, are regularly used. This produces a lessening of the symptoms or immunity against the diseases in question. (See IMMUNITY.)

Thus in the case of diphtheria, germs are grown on culture mediums and the poison developed by the

germs is injected into a horse. After an interval when the horse has developed anti-substance against the diphtheria poison, the blood of the horse is withdrawn. The serum is separated from the red blood corpuscles, concentrated, and this concentrated serum constitutes what is known as diphtheria antitoxin. Diphtheria antitoxin is one of the greatest discoveries contributed by modern medicine for the benefit of mankind. The credit for the discovery of diphtheria antitoxin is usually given to the German scientist von Behring and to the French scientist Roux.

If diphtheria antitoxin is injected early in the disease and in sufficient amount, it will save life in the vast majority of cases. In 1929 there were seven cities in the United States without a single death from diphtheria. Since 1890 the number of cities with rates under ten per one hundred thousand have increased year by year. From 1890 to 1894 many of the large cities of the United States had rates varying from 50 to 145. In 1927 there were only two cities with rates over 20.

In addition to antitoxin for diphtheria, through the discovery of Drs. George F. and Gladys Henry Dick, that the germ of scarlet fever exercises its effects on the human body through the development of toxin or a poison, it has become possible to prepare an antitoxin for this disease. The use of the scarlet fever antitoxin aids greatly in preventing death and serious complications from scarlet fever. (See also CHILDREN, DISEASES OF: Infectious Diseases.)

Antitoxins have also been made available for many other infections, notably tetanus or lock-jaw, in which the germs produce poisonous substances. M. F.

**ANTITRUST LEGISLATION.** Long before any statutory action against TRUSTS in the United States there had developed a body of legal doctrine on contracts in restraint of trade. For centuries the British rule had been that such agreements were void and unenforceable. By 1890 various breaches had been made in this rule permitting certain reasonable restraints such as one imposing upon a vendor of a business an obligation not to engage in that business in the immediate locality; i.e., the vendor received a price for GOODWILL. But after the overexpansion following the Civil War, and the panic of 1873, successful attempts to organize trusts and the anti-social methods of many of them created a very real degree of apprehension that common law limitations on monopolistic combinations were inadequate and that they must be reinforced by statutes. At least 13 individual states enacted antitrust acts prior to the Federal Act of July 2, 1890. With rare exceptions, however, little effort has been made to enforce these laws, chiefly because those in authority deemed it unwise and inexpedient to do so.

The SHERMAN ANTITRUST ACT of 1890 was passed with only one dissenting vote in the Senate and none in the House. It proceeded on the assumption that industrial combinations were not natural products of economic evolution but rather of the ingenuity of man. Consequently, every type of restraint on inter-

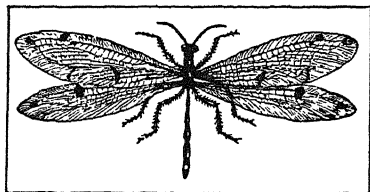
state and foreign commerce was prohibited; free competition was to be maintained by force. From the viewpoint of legal theory the chief result of state and Federal legislation prior to 1914 was to make positively illegal, and to provide penalties for participation in, certain contracts which the common law had only refused to support.

The FEDERAL TRADE COMMISSION and CLAYTON ACT of 1914, though maintaining competition as the ideal, reflect a different conception of the trust problem. The trust is viewed not as an octopus to be smashed with the club of a dissolution suit, but rather as the result of a number of malignant growths each of which must be cauterized. And so these laws contain only one general prohibition—against unfair competition—and a number of specific sections directed against particular monopolizing instruments of the old trusts.

Since 1914 the trend of Federal legislation respecting combinations, with the exception of the Radio Acts of 1927 and 1928, has been toward the relaxation of the strict adherence to LAISSEZ-FAIRE embodied in the Sherman Act. Steamship companies, exporters, marine insurance concerns, agricultural producers and workmen have all been exempted to greater or less degree from the prohibitions of the Sherman and Clayton Acts against combinations; and railroad and telephone companies have been specifically authorized to combine under supervision of the INTERSTATE COMMERCE COMMISSION. Indications are that this trend in legislation will continue to permit combination, under appropriate regulation, in other fields, such as the production of petroleum, lumber and bituminous coal in which competition has proved wasteful.

C. A. G.

**ANTIVENIN**, a serum from horses highly immunized to snake venom. Several types are made, each a specific for a given variety of venom. Thus, the *Crotalida* antivenin is used for bites from rattlesnakes, copperheads or moccasins, all of the family *Crotalidae*. Antivenin was first developed as an antidote to bites of poisonous Brazilian snakes, but the variety later developed for North American has been



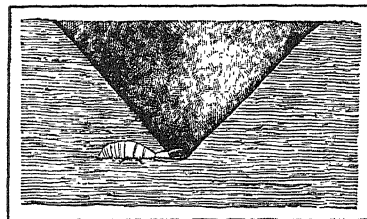
ANT LION  
(*Myrmeleon immaculatus*). Adult

equally successful. It is usually contained in a glass hypodermic syringe with a simple needle and plunger. The parts may be put together in a few seconds, and the injection given immediately. See SNAKE BITES.

**ANTLIA** (gen. *Anilia*), the air pump, an inconspicuous constellation south of Hydra. See STAR: map.

**ANT LION**, a genus (*Myrmeleon*) of neotropical insects. It is about  $\frac{1}{2}$  in. long when grown

and has enormous toothed jaws, short clubbed antennae and four narrow, netted-veined wings. The name is specifically given to the larva, which attracts more notice than the adult insect. The eggs are laid in dry sand, and as soon as the larva hatches, it begins to dig the little pits characteristic of its kind. With its front legs it lifts the sand to the top of its flat head, then jerks its head up and back, throwing the sand to a distance. When the conical pit is constructed, the ant lion awaits its prey at the bottom,



ANT LION  
Section of pit with ant lion (larva) in wait for its prey

and sucks the juices from the insects that come too near the edge and are carried down by the sliding sand.

**ANTOFAGASTA**, an important port of Chile, capital of the province of the same name, situated about 768 mi. north of Valparaiso. The terminus of a railroad which connects the Bolivian highlands with the Pacific coast, Antofagasta carries on a thriving trade with many inland towns. It ranks second in the republic in exports, and third in imports. Mining is the chief industry of the surrounding district, and the output of nitrate shipped by various nitrate companies is more than 1,000,000,000 lbs. yearly. Many of these companies are under American management and use American methods. Other exports are copper, silver, lead, borax, salt and iodine, of which Chile furnishes 90% of the world's consumption. Antofagasta was founded in 1870. Pop. 1930, 53,591.

**ANTONELLI, GIACOMO** (1806-76), an Italian prelate though not a priest, was born at Sonnino in 1806. He studied at the Grand Seminary at Rome and was such a brilliant student that he attracted the notice of Pope Gregory XVI who took him into his household. In 1845 he was made Minister of Finance and in 1847 a cardinal. Pius IX made him a member of his Ministerial Council, and he shared the Pope's temporary exile at Gaeta. Antonelli died in 1876.



ST. ANTONINUS  
From an engraving by Martin Schongauer

**ANTONINUS, ST.** (1389-1459), archbishop of Florence, was friend of Fra Angelico and Fra Barto-

lommeo, the Dominican painters. In 1436 he founded the Convent of St. Mark, of which Savonarola was to be the prior. Antoninus was the first self-trained historian of the modern Church.

**ANTONINUS PIUS**, a Roman emperor (138-161 A.D.), who, after a distinguished public career, was adopted by the emperor HADRIAN as son and successor. A just and merciful ruler he exercised economy in his administration, was generous to those in distress, and fostered toleration of all sects and creeds, including Christianity. Somewhat blind to the increasing danger of barbarian inroads across Rome's frontiers, he left to his successor MARCUS AURELIUS a heritage of war.

**ANTONY, MARK** or **MARCUS ANTONIUS** (83-30 B.C.), a triumvir, first becoming prominent through the favor of JULIUS CAESAR whose cause he supported so vigorously that he was driven from the senate-house on the outbreak of the civil war between Caesar and Pompey. Caesar's right-hand man throughout this struggle, he was Caesar's colleague in the consulship at the time of the latter's assassination on March 15, 44 B.C. Rousing the people against the assassins he forced them to leave Rome. Next he sought to wrest Cisalpine Gaul from its governor Decimus Brutus. But Octavian, the great-nephew and adopted son and heir of Caesar, obtained the support of the senate and several legions against Antony, defeating him at Mutina, in 43 B.C. Shortly thereafter Octavian, Antony, and Lepidus formed a coalition known as the second TRIUMVIRATE partitioning amongst themselves the administration of the state. After butchering their political enemies in Rome Antony and Octavian overwhelmed MARCUS BRUTUS and Cassius, the murderers of Caesar and champions of the old republican form of government, in the BATTLE OF PHILIPPI in Thessaly, 42 B.C. Antony now repaired to the east, where he fell under the spell of CLEOPATRA, lingering long at her court in Alexandria. As a pledge of friendship with Octavian, Antony married his sister Octavia. Antony was now formally assigned the government of the east, which he signalized by brilliant although unprofitable campaigns against the Parthians in Mesopotamia. In 37 B.C. the triumvirate was renewed for five years, but Antony's notorious infidelity to Octavia and his grant of kingdoms and provinces to Cleopatra alienated his supporters in Rome and led the senate to declare war against Cleopatra. Antony, defeated in the Battle of Actium in 31 B.C., fled to Egypt, where he died by his own hand.

G. M. H.

**ANTONY AND CLEOPATRA**, considered by many critics to be Shakespeare's greatest historical drama. Like the earlier *Julius Caesar*, this play was based on North's translation of Plutarch's *Lives*. It is generally conceded to belong to the poet's latter manner, the date usually set being 1607. *Antony and Cleopatra* is a tragedy of tremendous passions played against the colossal background of the Roman Empire. The action is sustained by four principal characters:

Cleopatra, the alluring, imperial daughter of the Ptolemies; the brave, often heroic, sometimes disgusting Antony, fascinated by Cleopatra, forgetful of his empire; Octavius Caesar, cool and never forgetful of Rome and the toss of chance; and Enobarbus, the friend of Antony, the faithful follower whom one sees transformed from a blunt, jesting soldier into a tragic figure who dies, embittered, in despair.

**ANTUNG**, a city in the southeastern corner of the Manchurian Province of Liaoning, China, and on the Chosen border, lying 30 mi. from the Yalu River. It can be reached by small coasting steamers. A railway bridge recently has been built connecting the Japanese-controlled South Manchurian railway lines in Manchuria and the Chosen Government lines in Chosen through Antung. The city was opened to foreign trade in 1903, and since that time it has developed chiefly as a center for the trade between Manchuria and Chosen and for exporting timber and wild silk. In total trade it ranks second to DAIREN among the Manchurian ports. Pop. 1929, approximately 74,000, of whom a fairly large proportion are Japanese.

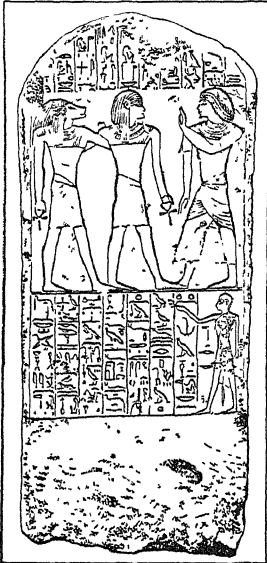
**ANTWERP**, the commercial center and chief port of Belgium, situated on the wide river Scheldt 50 mi. from the sea. In the 16th century the city was one of the greatest in Europe and Antwerp's harbor has long been world-famous. The religious wars practically destroyed it, and by closing the Scheldt in 1648, the Peace of Westphalia ruined the business of the port. In 1800 Antwerp had a population of less than 40,000. Its riches seemed definitely past, when Napoleon, sensing the port's new possibilities, ordered its reconstruction. All limitations and tolls on the river's navigation were removed in 1863. Since then Antwerp has witnessed two remarkable feats of recovered prosperity: first, that which followed the freeing of the port, and, second, the achievement of trade after the end of the World War. Although strongly fortified, Antwerp was taken by the Germans in Oct. 1914 after a destructive bombardment. In 1922 within four years of the close of the war, the in-bound tonnage was 15,050,182; in 1927, 23,490,300 tons. A large and handsome city, Antwerp possesses a notable Gothic cathedral in which hang Rubens' masterpieces, *The Descent from the Cross*, *The Assumption* and *The Elevation of the Cross*. The art museum is rich in paintings by Rubens, Van Dyck and other important masters of the Dutch School which flourished here in the 17th century. The home of the 15th-century printer, Plantin, is intact as a museum. Pop. 1930, 299,190.

**ANTWERP, SIEGE OF**, Sept.-Oct. 1914, a major action in the WORLD WAR which marked the opening of the second German offensive. A necessary preliminary was the destruction of the Belgian forces which, entrenched between the double circle of forts protecting Antwerp, had made damaging sorties on the German right flank. This in turn necessitated the demolition of the 31 forts, manned by only 40,000 men. Between the Senne and the Grand Nethe, from Sempst to Heyst, Falkenhayn massed 185 pieces of



field artillery, 48 long guns, 120 howitzers, and 15 super-heavy howitzers of 42 centimeters, previously employed against Liège and Namur. A terrific bombardment began on Sept. 28, continued without respite until Oct. 2, and destroyed the outer forts, which the Belgians evacuated Oct. 4. To save Antwerp from needless destruction, the civil authorities capitulated Oct. 10, and the Belgian army withdrew across the Scheldt.

**ANUBIS**, an ancient Egyptian god in the form of a jackal, or with a human body and a jackal's head.



COURTESY M. M. OF ART

ANUBIS CARVED ON EGYPTIAN  
STELE OF THE 18TH DY-  
NASTY

He assisted the goddess Isis to bury the god Osiris, and thenceforth became the god of the dead of the sepulcher and of embalmment.

**ANVIL**, a block of metal, usually iron or steel, on which the blacksmith forges hot metal into various shapes. When power hammers were devised, the block that received the blow was naturally called the anvil. Also that part of a measuring instrument against which the piece to be measured rests, and which receives the pressure is termed an anvil.

**AORTA.** See ARTERIAL SYSTEM.

**AOUDAD**, a peculiar wild sheep of northern Africa known commonly as the Barbary sheep. It frequents the dry southern

slopes of the Atlas Mountains from the Atlantic to Tunis, its tawny coloration enabling it to hide among the rocks. The aoudad (*Ovis lervia*) differs conspicuously from other wild sheep in the profuse mane of long whitish hairs masking throat, breast and forelegs, in the unusual length of the tufted tail, and the large size of the somewhat goatlike horns in the ewes. This



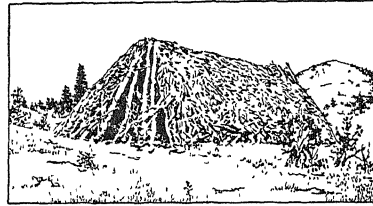
COURTESY AMER. MUS. OF NATL. HISTORY

SAN CARLOS APACHES BUILDING A HOUSE

large, heavy animal, measuring 39 in. at the shoulder, has considerable powers of speed. It breeds freely in confinement.

**APACHE**, a group of North American Indian tribes forming with the Lipan and Navaho the South-

western division of the great ATHAPASCAN linguistic family. They are known to have covered a vast territory from southeastern Arizona, southwestern New Mexico, western Texas and northern Mexico, terrorizing the inhabitants, both Indian and white, and making the name of Apache a by-word for ferocity and craftiness. Governmental and even tribal organization was almost entirely lacking; bands merged, separated and changed their locality constantly. Agriculture was practised to a limited extent before their settlement on reservations. Roots, berries and game,



COURTESY AMER. MUS. OF NATL. HISTORY

WHITE MOUNTAIN APACHE HOUSE

with the exception of bear and fish which were plentiful but tabooed as food, constituted their main source of subsistence. Shelters were easily made huts of brush, erected by the women. Basket-making was their only well developed art. Two main divisions may be distinguished, the eastern and western. The eastern Apache, comprising the Mescalero and Jicarilla, lived chiefly in the mountains at the edge of the Great Plain east of the Rio Grande and were known to the Spaniards as *vaqueros* (buffalo hunters) and



COURTESY AMER. MUS. OF NATL. HISTORY

APACHE FAMILY LIFE

*llaneros* (plainsmen). The western Apache occupied the territory around the upper drainage of the Gila river in southern New Mexico and Arizona and included the Chiricahua, Arivaipa, Coyotero, Pinaleno and others. The most serious activities against the whites were caused by mismanagement on the part of civil authorities in ruthless appropriation of lands and shifting of reservations. The Chiricahua successively led by Cochise, Victorio and Geronimo were the last to be subdued, their uprisings occurring as late as 1900. See also JICARILLA; KIOWA; LIPAN; MESCALERO; WHITE MOUNTAIN APACHE.

**APALACHEE**, a tribe of the Muskogean linguistic stock, one of the chief aboriginal Indian groups

of Florida, their habitat having been north of Apalachee Bay from Pensacola east to the Ocala River. Their closest linguistic affiliation was with the CREEK Indians. Their contact with whites began with the Spanish expeditions of Pánfilo de Narvaez in 1528 and Hernando De Soto in 1539. These new-comers were at first met with resistance but the Apalachee soon fell under the influence of Franciscan missionaries. In the 18th century their towns were continually raided by the Creek, encouraged by the English, an attack under Gov. James Moore of South Carolina resulting in the destruction of their towns and fields and the enslavement of more than 1000. A later expedition almost completed their extermination. The remaining Apalachee were given shelter by friendly neighboring tribes or by the French in Alabama, while others merged with the Creek.

**APALACHICOLA**, a port town in northwestern Florida, the county seat of Franklin Co. It is situated on the Gulf of Mexico, at the mouth of the Apalachicola River, 220 mi. southwest of Jacksonville. Steamships and the Apalachicola Northern Railroad serve the town. The good harbor is protected by several islands, and its traffic annually amounts to more than \$1,000,000. Boat-building and lumber manufacture are important in the town, and such commodities as oyster shell, sea foods, cigar boxes and chicken grit are produced. Pop. 1920, 3,066; 1930, 3,150.

**APALACHICOLA RIVER**, a river of northwestern Florida, a continuation of the Chattahoochee and Flint rivers which unite at the southwestern corner of Georgia. The Apalachicola flows almost directly south and empties into the Gulf of Mexico through Apalachicola Bay. Its length is about 90 mi. and it is navigable by steamboat throughout its course. The cities of Taluga and Apalachicola are located on its banks and the Chipola River joins it near its mouth.

**APARTMENT HOUSES.** The modern apartment house was created for families desiring to keep up the family home although not able to afford an individual plot of ground and an entire house. An apartment may also be referred to as a tenement, a flat, or a multiple dwelling. The apartment should be distinguished from the hotel, the inn and the boarding house, where the family depends upon the common kitchen and is relieved of individual house-keeping. Originally hotels and inns catered to transients. Adjoining rooms or rooms en suite could be rented, but rooms were not arranged in apartments. After the World War, due to the housing shortage and increased costs, a great change in family life took place. The average family faced the problem of living in smaller quarters and fewer rooms. The newer hotels were planned for the family desiring to live in either way. Apartments, except for people of unlimited means, tended to grow smaller both as to the number of rooms and as to the size of the individual rooms, so that the old distinction between the apartment and the hotel was greatly lessened. The newer term, multiple dwelling, includes all types.

**The Apartment and Land Value.** For some time the belief has persisted that apartments increase the value of the land, and that tenants in apartments must put up with cramped quarters and lack of sunlight because of the high land value. Both of these concepts have grown up as a result of the exploitation to which the public has become accustomed in periods of rising prices following an economic upheaval. Real property is subject to the same laws as govern all values. It is more difficult, however, to recognize a temporary shortage of supply which may for a while disrupt its prices. The total needs of the community set the total value of the living quarters of the community. When a new apartment house is finished, since it supplies additional quarters, it tends to lessen the value of all other apartments and all other land. If it has the new popular features it draws tenants away from older properties.

If the new apartment is especially desirable, so that it improves the neighborhood in which it stands, it may cause an apparent increase in the value of the immediately surrounding land. The popularity of a certain neighborhood where modern apartments have been erected frequently tends to limit the high class development to that particular neighborhood so that land values in that neighborhood are likely to increase. In smaller cities and towns where zoning laws exist the areas in which apartments are allowed are sometimes so greatly restricted that the price of land within apartment zones becomes almost prohibitive. The increase in price, however, is due directly to the popularity of the particular land and only indirectly to the apartment.

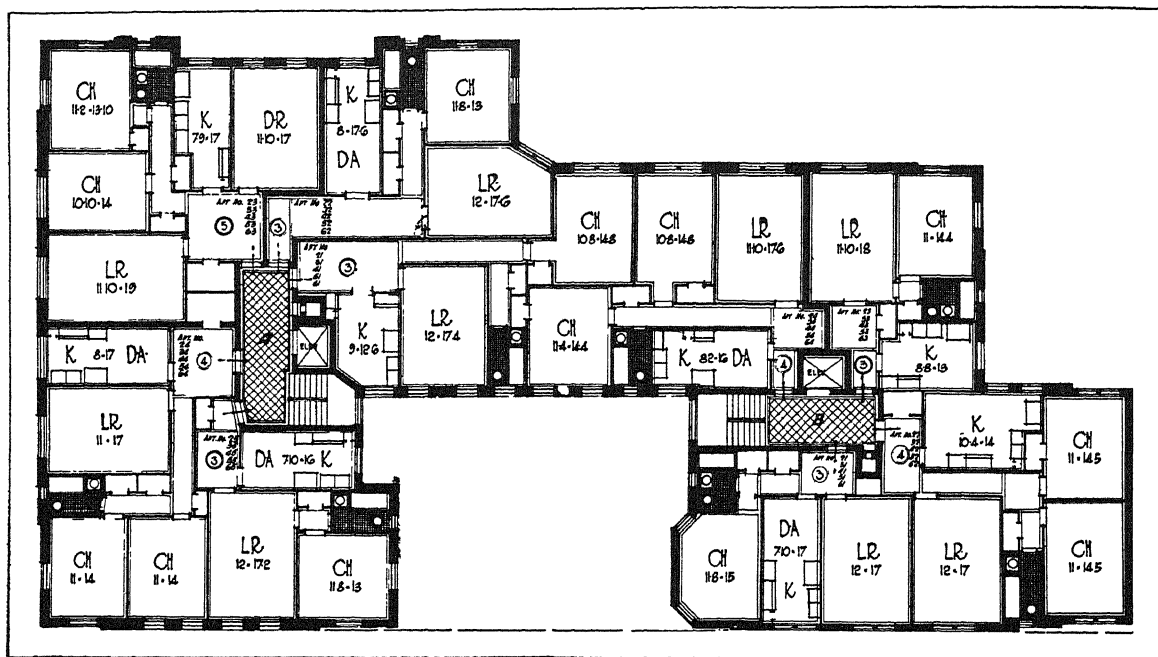
The apartment type has in fact tended to reduce the average value of land in general by reason of the more intensive use which can be made of land for residential purposes. Recent years have seen phenomenal urban growth and a mechanization of city life. Rapid transit including both the fast electric railway and the automobile have brought many square miles of new land within the range of the city commuter. The first rush to speculate in this new land has now given place to a realization that we must revise our old ideas of land values and land use. To-day the average family can be housed on far less land than formerly required. Although it costs a great deal of money to convert farm land into building lots, if lots are created faster than the public can use them, they may absorb more money, even though held for a high price, in carrying costs than they can possibly earn even when put to apartment use. So much city land is now available that were it not for sales to land speculators the price of city lots could not possibly be maintained.

**Construction Costs.** During 1929, 1930 and 1931, due in part to the general world-wide economic depression, building prices fell. There was at the same time a search for new methods of construction. Labor-saving devices which may be applied to the building industry, will undoubtedly in time establish quantity production so that the price of construction is

likely to continue to fall. In addition great progress has been made within the last few years in the science of housing wherein planning is properly related to the underlying factors of land use, production cost, maintenance and rentals earned. The new housing science is making it possible to improve living facilities that are being provided for the great mass of people whose incomes are less than \$3,000 a year. Since about 1880, the majority of homes have been provided for by speculators and have been built for immediate profit. In the main speculative developers have been dependent upon a turnover of the completed property by a sale in order to get their money out of it before the usual rapid depreciation and obso-

ment of units around a large central court or around open lateral courts.

**City Apartments.** In the cities the trend is toward larger projects, which are virtually self-contained communities. Notable among these are the Amalgamated Dwellings, Inc., a cooperative development of an entire city block on Grand St., New York, designed by Springsteen and Goldhammer, architects, and the Michigan Boulevard Garden Apartments in Chicago, financed by Julius Rosenwald and designed by Grunsfeld and Klaber of Chicago, in collaboration with Henry Wright of New York. In the Amalgamated block for a down payment of \$150 per room and the payment of a maintenance charge of \$12.00



COURTESY SPRINGSTEEN AND GOLDHAMMER, ARCHITECTS

FLOOR PLAN FOR A QUARTER SECTION OF THE GRAND STREET APARTMENTS, NEW YORK CITY. THIS PROJECT WAS AWARDED THE 1930 APARTMENT HOUSE MEDAL OF THE NEW YORK CHAPTER OF THE AMERICAN INSTITUTE OF ARCHITECTS

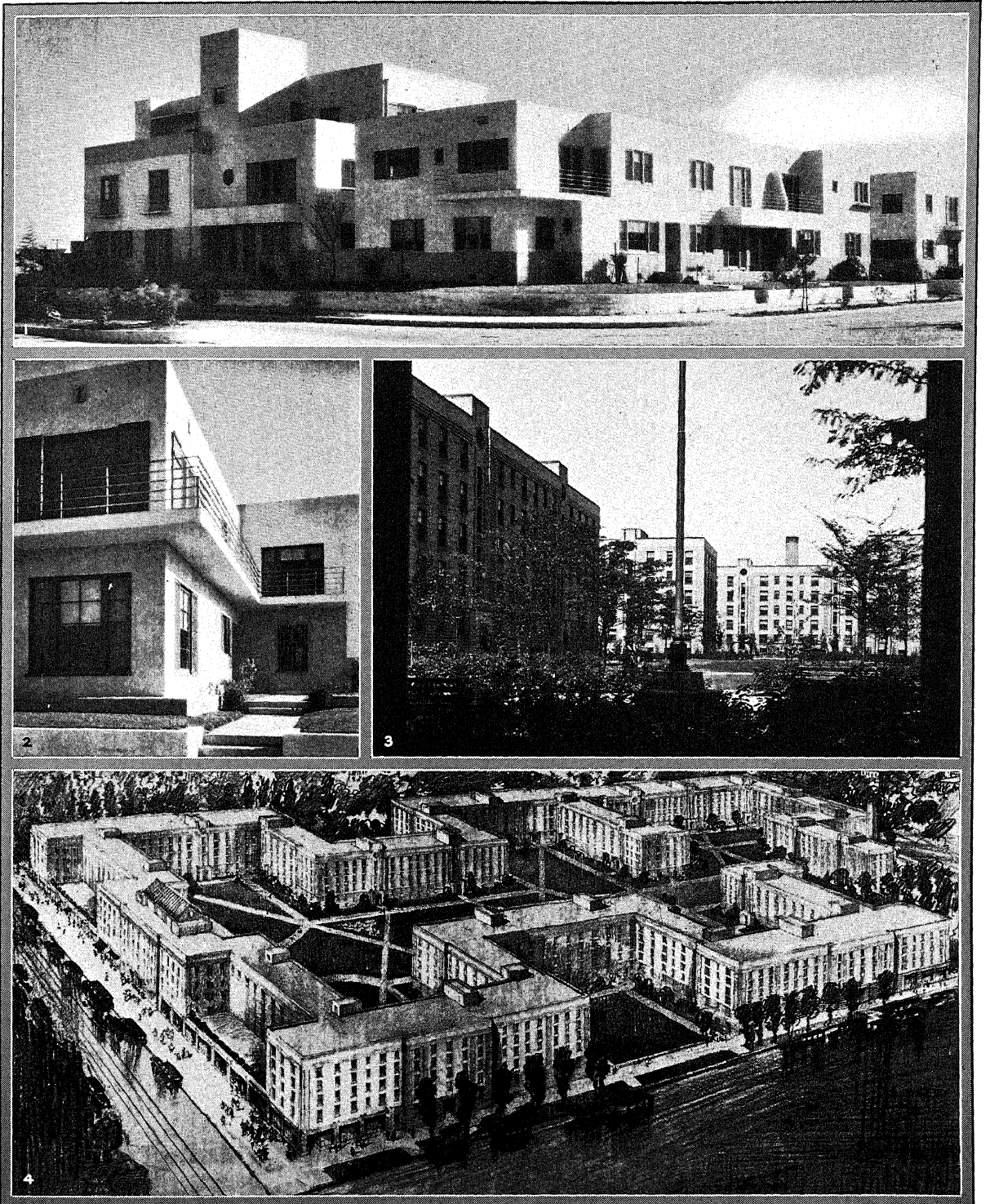
lucence set in. In the immediate future, homes for the lower income groups will undoubtedly be found in the depreciated class of buildings which have already been built without consideration of permanent value. As large scale operations develop and methods of building finance are improved there should be more projects which are planned for a long period of stable rental return where both the design and the method of construction will be such that the building will be subject to minimum depreciation and obsolescence.

**Apartment Planning.** There are two primary features to apartment planning: first, the building plan; second, the room arrangement. So far as the plan of the building is concerned the tendency has been to work away from the old type of apartments on a narrow city lot with narrow, dark courts. The best recent buildings cover approximately 50% of the lot or less. The building plan consists of an arrange-

ment of units around a large central court or around open lateral courts. per room per month, one may purchase cooperatively an apartment of from three to five rooms with completely equipped kitchen, tiled bath, incinerator, and elevator service. The land on which the buildings were erected cost \$5 per square foot. These buildings are under the supervision of the New York State Board of Housing, and as a result taxation is limited for 20 years to land value only. The Chicago apartments are built on land costing \$2.30 per square foot and rent for approximately \$16.25 per room per month.

In the higher rental field the trend away from the overcrowding of the land is marked by such developments in New York as Tudor City, by Fred F. French; London Terrace, designed by Farrar and Watmough; and the Garden Plan Apartments, designed by Leonard Cox, Arthur C. Holden & Associates.

## APARTMENT HOUSES



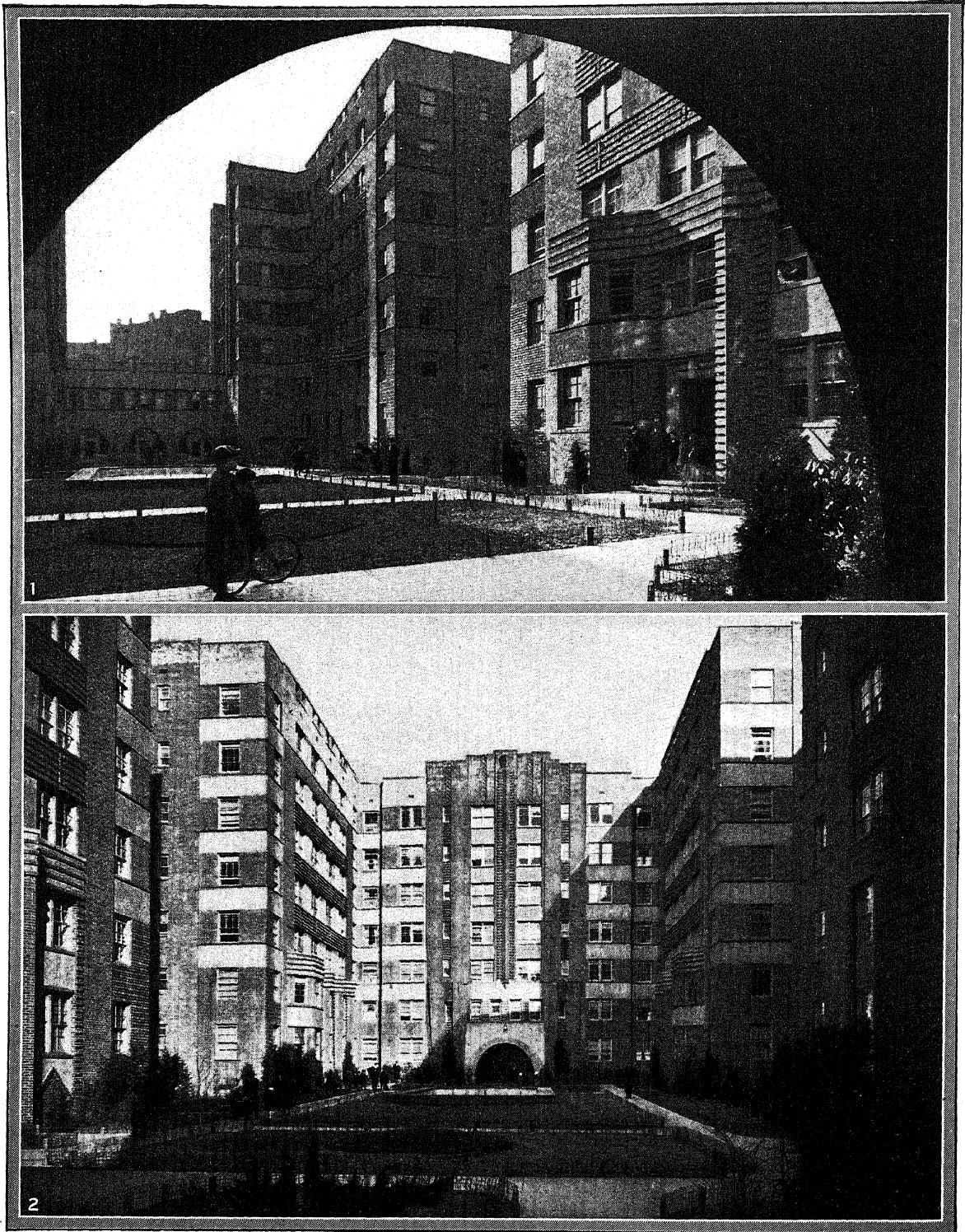
### MODERN APARTMENT ARCHITECTURE IN THE UNITED STATES

1. The Baxter Avenue Apartments, Los Angeles, California. Franz Herding and George J. Adams, Architects. 2. Entrance and second story balcony of the Baxter Apartments. 3. Interior court of the Michigan Boulevard Garden Apart-

ments, Chicago, Illinois. Eugene H. Klaber and Ernest A. Grunsfeld, Jr., in collaboration with Henry Wright of New York, Architects. 4. General view of the Michigan Boulevard Garden Apartments, from the architects' drawing.



## APARTMENT HOUSES



SAMUEL H. GOTTSCHO PHOTOS

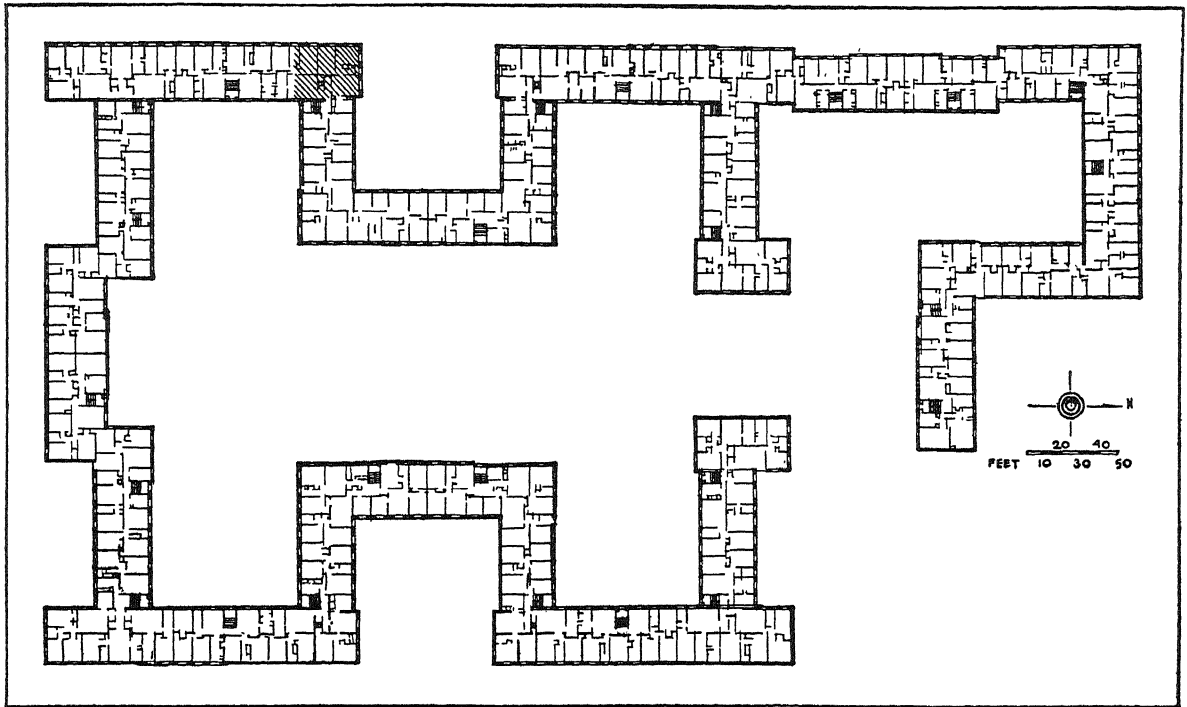
### AN APARTMENT HOUSE OWNED BY ITS TENANTS

Apartments in the Grand Street Apartment House, New York, are coöperatively owned by the tenants, and operating and maintenance expense is paid monthly by each tenant-owner. 1 and 2 show views of the interior court from

opposite ends. The 1930 Apartment House medal of the New York Chapter of the American Institute of Architects was awarded to this structure, designed by Springsteen and Goldhammer.

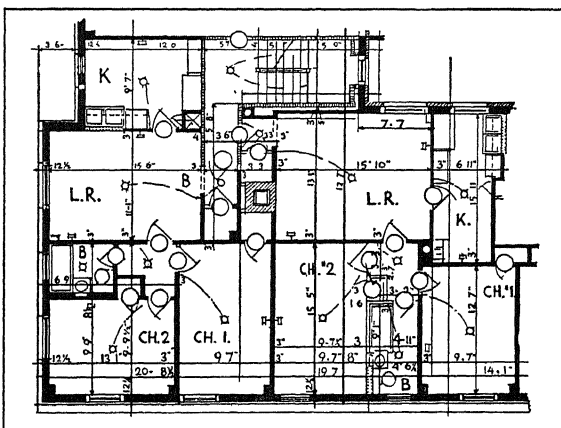
**Suburban Apartments.** The rise in the general cost of living following the World War created a demand for apartments in the suburbs. Due to land speculation the first types of buildings introduced differed

been to increase costs, overcrowd the land and to stabilize the undesirable types. Recently there have been distinct advances in the planning of apartments for the suburbs. Bronxville, N.Y., located on the Bronx



TYPICAL FLOOR PLAN FOR THE MICHIGAN BOULEVARD GARDEN APARTMENTS, CHICAGO, ILLINOIS  
*Eugene H. Klaber and Ernest A. Grunsfeld, Jr., Architects*

very little from the well-known types already prevailing in the cities. The yards and courts were slightly larger, and some attempt was made to preserve trees

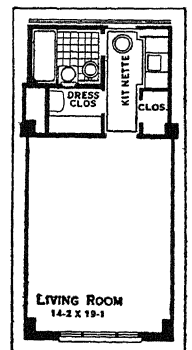


TWO TYPICAL APARTMENTS OF THE MICHIGAN BOULEVARD GARDEN APARTMENT HOUSE, CHICAGO  
*Eugene H. Klaber and Ernest A. Grunsfeld, Jr., Architects*

and shrubbery. Most of the legislation enacted by suburban communities restricting apartment development was designed to prevent the building of city types in the country. In some cases the effect has

River Parkway, has been a center for the better grade of development. Suburban apartments must fit into the community. They must not spoil the neighborhood into which they come by overshadowing the private residences. The plan must not depend upon borrowed light for outlook for desirability.

**Room Arrangement.** Room arrangement is best discussed by reference to the illustrations selected. The basic types are: 1, single room with accessories for cooking and with the closet door disappearing into which they come by overshadowing the private residences. The plan must not depend upon borrowed light for outlook for desirability.



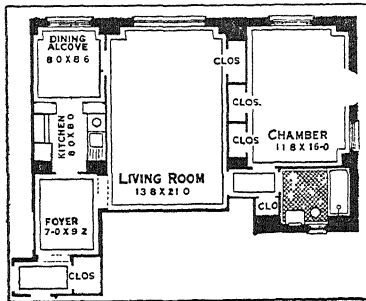
COURTESY SUGARMAN AND BERGER

**ONE ROOM**

Plan utilizes entire frontage for lighting living room, kitchenette and bath having no daylight



have been introduced to give the tenants some of the benefits of the larger apartments within small compass. In the upper rental range, the principal demand has



COURTESY ROSARIO CANDELA

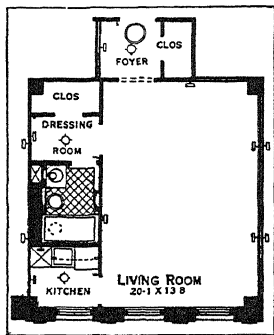
#### TWO ROOMS, DINETTE

*Plan provides separate access from foyer to living room and kitchen. Second foyer allows privacy of bedroom and bath.*

dropped to the smaller units of three rooms and four rooms instead of the formerly prevalent types of five rooms for the standard family.

#### Stylistic Development.

There has been much interest recently in the so-called modern style which will break away from known precedents in architecture. There is in the field of apartment house design a great opening for new methods of expression. Basically designs should reflect the materials and the construction of a building. In so far as modern design is an outgrowth of the changing use of materials it will probably develop and flourish. Where, however, it is a



COURTESY GEORGE G. MILLER

#### ONE ROOM

*Floor plan locates kitchen where it will have daylight and outside air.*

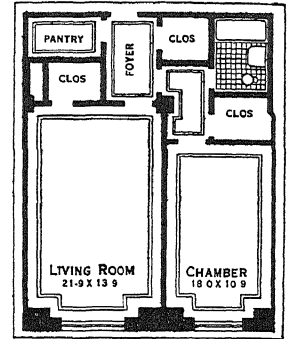
mere affectation or imitation of appearances it will not hold its vitality. In comparatively recent years architects have learned that the detail of apartment houses was out of scale with the large scale conception. The influence of modern materials has tended to simplify ornamentation and to increase the sincerity of design.

On the west coast of the United States, as well as in Austria and Germany, the modern tendencies are most apparent. The Baxter apartments in Los Angeles, the work of Franz Herding and G. J. Adams, is one of the best examples of the newer tendency. A. C. H.

**European Apartment Houses.** Modern European apartments fall naturally into two classes: the

lavish buildings of large apartments for the well-to-do, and the great groups of industrial housing, mostly built under municipal auspices. In the first group, the French are still preeminent, and contrive to obtain a great amount of style in their brilliant, if conservative, planning. But the service arrangements are frequently extremely inefficient, and the plan wasteful in its use of long corridors. In the larger modern English apartment houses, American influence is marked, especially in the reduction of the number and size of rooms, and the study of plan for economy of corridor space. Devonshire House, London, by Thomas Hastings and C. H. Reilly, and Crophorne Terrace, Maida Vale, by Sir G. G. Scott, are characteristic of this trend.

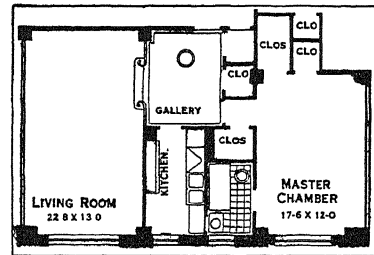
The greatest development of the smaller apartment for people of lower income is thus far found in Ger-



COURTESY FARRAR AND WATMOUGH

#### TWO ROOMS

*Plan adapted to narrow frontage, using central foyer and facing kitchenette and bath to interior.*

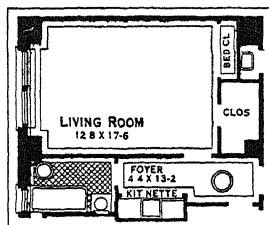


COURTESY SCHWARTZ AND GROSS

#### THREE ROOMS

*Plan provides central foyer from which living room, bedroom and kitchen are entered. Living room is two steps below level of foyer.*

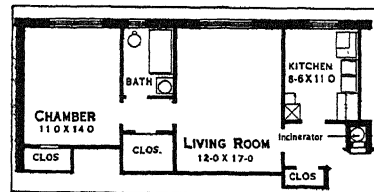
many and Austria, though recently Soviet Russia has been building many interesting apartment groups planned to give the maximum of light, air and comfort economically. The secret of the German and



COURTESY SUGARMAN AND BERGER

#### ONE ROOM

*Floor plan in which foyer is so arranged that stove need not be passed on entering and so that bath is not entered from living room.*



COURTESY CLARENCE S. STEIN

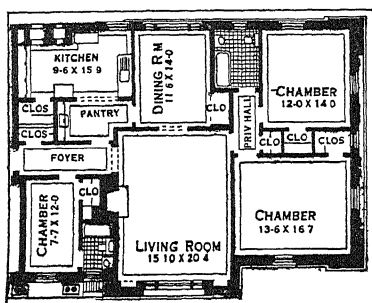
#### THREE ROOMS

*Plan provides generous frontage and a large kitchen. Living room must be crossed to enter bedroom.*

Austrian success is in two things, large scale planning, and in municipal, or municipally aided, financing. The first allows an adequate site to be chosen, and apartments built as a group, a community, with all its

buildings correctly related both aesthetically and practically, and tree lined streets, park spaces, and gardens made an integral part of the whole. (See *TOWN PLANNING*.) The second prevents the profit motive from being completely dominating, and thus allows the use of color, sculpture and appropriate decorations.

In the planning of individual buildings, the tendency is towards strict economy of space. Rooms are comparatively small, but carefully studied for furniture arrangements and lighting. In general there are



SIX ROOMS  
Plan provides light on three sides. Servant's bedroom is so arranged that it may be used as a third master bedroom

several entries and separate staircases in each building, so that public halls are eliminated. Window areas are large, and usable balconies common. Bathrooms, while not universal, are present in a continually growing number of apartments; but private toilets are universal. Exterior treatment, though varying greatly, is always modern and non-stylistic, and frequently color plays a great portion in the design. Good examples are to be found around Berlin, Dusseldorf, Stuttgart and Vienna, and of a more superficially picturesque style, in the Dutch cities of Amsterdam and Rotterdam.

T. F. H.

**BIBLIOGRAPHY.**—J. T. Boyd, "Garden Apartments in Cities," *Architectural Record*, July and August, 1920; R. W. Sexton, editor, *American Apartment Houses of To-day*, 1917; Henry Wright, "The Modern Apartment House," *Architectural Record*, March, 1929.

**APATITE**, a mineral which is a constant, minor accessory constituent of many IGNEOUS and METAMORPHIC ROCKS. Some pegmatites and metamorphosed limestones contain large amounts of apatite, and it not infrequently occurs with magnetic iron ores. When pure the mineral is colorless, but it is ordinarily green, pink, blue, purple or violet. Although somewhat soft, clear varieties are used for gems, the material usually being found in hexagonal crystals. Gem apatite comes from Germany, Bohemia, Switzerland, Ceylon and the State of Maine.

Phosphates for fertilizers can be made from apatite, as it is a calcium phosphate, with some fluorine and chlorine. The availability of PHOSPHATE ROCK makes apatite unimportant for this purpose, however, except where it is a residue from iron ore concentration, as in the Adirondacks, or where PEGMATITE veins can

be mined, as in Canada and Spain. The GANGUE of metalliferous veins, especially of tin deposits, often contains apatite. See also SCHEELITE; MINERALOGY; PETROLOGY; HEXAGONAL SYSTEM; GEM STONES.

**APE**, a popular name which used to be applied to any Primate, but which is now frequently restricted to the anthropoid or man-like apes. These are the gibbons, the orang-utan, the chimpanzee, and the gorilla. They are man's closest living relatives.

The anthropoids are tailless; they have opposable thumbs, a vermiform appendix, and their arms are longer than their legs. Gibbons, oranges and chimpanzees are very much at home in the tree-tops, and swing from branch to branch with the greatest ease. Gorillas are rather less expert as acrobats, and are more terrestrial in their habits. Gibbons habitually walk erect on the ground, as do chimpanzees, though the latter run on all fours. Gorillas, in walking, use their long arms in a crutch-like fashion. See also ANTHROPOID APES; CHIMPANZEE; GIBBON; GORILLA; ORANG-UTAN.

**APELDOORN**, a city in the Dutch province of Gelderland, located on the Apeldoorn Canal. It has numerous paper factories manufacturing paper products, most of which go to the Dutch East Indies. Fifteen miles north of Apeldoorn is the royal castle Het Loo, the summer residence of the Dutch rulers. Pop. 1930, 60,480.

**APELLES** (4th century B.C.), Greek painter, was born about the middle of the 4th century B.C. in Ionia, Asia Minor, probably at Colophon. Apelles was the most celebrated painter of ancient times. Court painter to Philip and Alexander, he was the intimate companion of the latter. Besides his celebrated portrait of Alexander, and his portraits of Philip and various Macedonian generals, Apelles painted mythological and allegorical subjects. The subjects of these paintings have in many cases survived and were the inspiration of several Renaissance painters. The outstanding virtues of Apelles's painting are said to have been accurate drawing and extraordinary grace. He died late in the 4th century, probably at Cos.

**APENNINES**, a mountain range of Italy, a geologic extension of the Alps, skirting the Gulf of Genoa and traversing the whole peninsula to continue into Sicily, for a total distance of 800 mi. Its estimated maximum width is 80 mi. Geographers generally place the boundary line between the Alps and the Apennines at the Bocchetta dell' Altare. The northern mountains, the Ligurian and Etruscan, extend into Tuscany; they follow the seaboard closely, sloping sharply to the coast, and more gently to the Po valley; the principal peak is Monte Cimone, about 7,000 ft. high. The central ranges, the Umbrian, Roman and Abruzzian Apennines, stretch from Tuscany across to Abruzzi. In this section is Monte Corno, 9,560 ft., loftiest peak in all the Apennines, a part of the Gran Sasso d'Italia, and to the north are the rugged and rich marble-bearing mountains of Carrara, Seravezza and Siena. There are many snow-covered peaks and passes. The southern, the Neapolitan and Calabrian

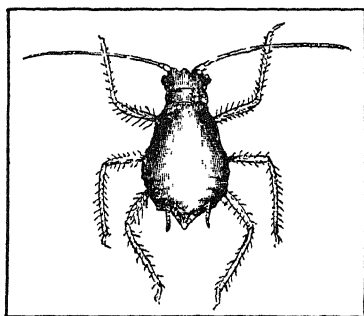
Apennines, extend to the toe of Italy and are generally lower and less rugged, with Monte Pollino, reaching a height of more than 7,000 ft. A fourth division consists of the Sicilian Apennines. Many streams rise in the range, a number of them draining to the Adriatic; both the Po and the Arno have their sources here. The southern section overlooks a countryside whose vegetation is almost tropical.

**APEX**, in astronomy, indicates that point in the sky toward which the sun and the solar system are moving.

**APHASIA**, the loss of speech arising from destruction of brain centers concerned in speech and understanding of language. There are two varieties, depending upon whether motor centers or sensory centers are affected: (1) In Broca's or motor aphasia, although the muscles used in speaking are not paralyzed, there is loss of the ability to speak. With this there is usually word blindness or the inability to understand written or printed language even though the person is not blind and can recognize objects other than the word symbols. It is also usually combined with inability to write (agraphia) or with paralysis of the right side of the body in right-handed or of the left side in left-handed persons. (2) In Wernicke's or sensory aphasia there is "word deafness" or the loss of ability to understand words that are spoken, without loss of hearing or of the ability to understand the meaning of other sounds. It may be combined with word blindness and always causes severe difficulty in speaking. This form is the more serious, as it means a loss of the largest channel of information concerning the world around. H. D. S.

**APHELION**, that point in the orbit of a planet or comet which is farthest away from the sun.

**APHIS**, small insects of the order *Homoptera*, possessing sucking mouthparts and often called plant lice. They are very injurious to many cultivated plants, from which they suck the sap. Different species of aphid attack the young leaves, roots, bark, buds or fruit and some species cause the formation of galls



APHIS  
Greatly enlarged

on stems or buds. Honeydew, a sweet substance excreted by aphid, is eagerly eaten by bees, wasps and ants and some kinds of ants care for and protect colonies of aphid much as men care for herds of cattle. Black smut fungus often grows on leaves

coated with honeydew. Many species of aphid have a complicated life history, involving two or more species of host plants. During the summer months, large wingless females bring forth living young from unfertilized eggs. In most species a sexual generation of winged forms occurs in the autumn. Lady-bug beetles and the larvæ of the lacewing fly feed upon aphid, and the larvæ of certain tiny wasps are parasitic within their bodies. Contact sprays are sometimes useful in the control of aphid.

**APHRODITE**, the Greek goddess of love and beauty, identified with the Roman *VENUS*. As her name implies, she emerged from the foam, *aphros*, of the sea. The golden apple was awarded to Aphrodite by *PARIS*. In an amour with a mortal, *ANCHISES*, she became the mother of *AENEAS*, the Trojan hero. Aphrodite possessed a magic girdle which inspired love in those who wore it. The myrtle, rose, apple, poppy and other fruits and flowers were sacred to her. She was attended by Cupid, and had as messengers the sparrow, dove, swan, swallow and other birds. Of statues representing Aphrodite, the most famous is the so-called *Venus of Milo*, now in the Louvre, which was found on the island of Melos in 1820. In the Bible she appears as *Ashtoreth* or *Astarte*. See also *ADONIS*.

**APIA**, a seaport on the north coast of *Opolu*, *Samoa* Islands. It is the chief trading center of *Samoa*. The place was the scene (Mar. 15, 1886) of a hurricane which destroyed one American and two German war vessels. It was seized in 1914 by an expeditionary force from *New Zealand*. *Robert Louis Stevenson* was buried near *Apia* in 1894. Est. pop. 1931, 1,500.

**APICULTURE**. See *BEE-KEEPING*.

**APIS**, the sacred bull worshiped by the ancient Egyptians at *Memphis*. It was regarded by them as an incarnation of the great god *Osiris*, and treated with extraordinary deference and consideration. Every *Apis* was required to bear certain marks: an eagle-shaped figure on the back, a crescent on the forehead and a black knot under the tongue. On the death of every *Apis* (none was permitted to live more than 25 years) another was sought and, when found, borne in triumph to *Memphis*.

**APLANATISM**, the condition existing in a system of lenses or mirrors when they are free of spherical or chromatic aberration (see *ABERRATION IN OPTICAL SYSTEMS*). More broadly, it is the condition existing in a system comprising one or more reflecting or refracting surfaces when the length of the optical paths from a point *A* to a point *B* by way of these surfaces is a constant. Thus *A* and *B* may be the two foci of an elliptical mirror.

**APLITE**, an *IGNEOUS ROCK*, fine-grained and light in color, occurring as *DIKES* and *VEINS*. It is a *QUARTZ* containing considerable *MUSCOVITE*, with *GRANITE* and *ORTHOCLASE* also present. See also *GRANITE*; *DIKE*; *PETROLOGY*.

**APOCALYPSE**. See *REVELATION OF ST. JOHN THE DIVINE*.

**APOCALYPTIC LITERATURE** (Greek, *apocalypsis*, or revelation), Jewish books containing the revelation of the wonderful future which was conceived of by their authors as about to be realized very soon. All the apocalyptic books of Jewish origin predict the speedy coming of final and complete salvation and deliverance. The sad affairs prevailing in Israel at the time of writing, the national sorrow and oppression, foreign persecution, and the lack of all justice, persuaded the individual authors that God must indeed have a purpose in mind in thus bringing all these misfortunes upon His chosen people. This purpose must be the eventual deliverance of the world through Israel, and the final salvation of the Jewish people and eventually of all mankind.

This type of literature was especially popular between the years 170 B.C. and 100 A.D., and Neo-Hebraic apocalyptic literature continued to be written to the very end of the medieval period. It originated in Palestine, but almost simultaneously spread to Alexandria, in Egypt, which was then an outstanding Hellenistic city. Forerunners of a revelational and apocalyptic nature were not lacking in the Bible itself. The book of Daniel was actually the oldest Apocalypse, with its marvelous predictions of the glorious "time of the end" and its symbolical portrayal of the future (actually already occurrences) fall of the dominant nations under the simile of animals. Again, there were the glorious visions of the prophet Ezekiel. Finally, Christian literature had later adopted the apocalypse, the most outstanding example of such adoption being the book of Revelation, the last book of the New Testament.

In form the apocalypse was a lengthy and highly developed vision, not ecstatic in nature, but revelational and prophetic. The author of each and every apocalypse is anonymous, and the book is always ascribed to some famous Biblical hero of antiquity, who is represented as declaring or predicting the events of the future by virtue of his prophetic gifts and powers. In actuality, however, all the apocalypses, like that of Daniel, were written after the events which they purport to predict had taken place. Together with these pseudo-predictions of the future there are bound up the hope in the Messianic kingdom for the Jewish nation, the hope in the future world for all mankind, and the hope of life after death for the individual soul. God will bring about the kingdom of heaven through the aid of the angels, or as the result of natural catastrophes which shall overthrow His enemies, who are also the enemies of Israel. But it is to be noted that in all the Jewish apocalypses the Messiah is portrayed as a human being of the tribe of David. The future world will be a better age, a spiritual and superterrestrial world which will come into existence after the present world of imperfection and evil has endured for the determined number of years. This final time, this "time of the end," is frequently conceived of as to be preceded by a number of cosmic or natural catastrophes such as eclipses of the sun, moon or stars, the bleed-

ing of trees, inordinate strife between relatives, the howling of stones, and the like; then the fallen angels, the demons, and Satan will make their last struggles on earth before they are finally doomed to utter destruction and annihilation. Finally God intervenes, renews the world, abolishes death, resurrects the long since dead, and condemns the wicked to eternal torment and destruction. The guerdon of the righteous and pious is to be eternal life.

Many of the apocalyptic ideas seem to be of assured Babylonian origin, while others were certainly based on Egyptian myths and on Persian and Iranian religious views. Practically none was original with the Jewish writers of the apocalypses. Nevertheless, official Judaism, in the course of the years, actually adopted much that was contained in the apocalypses, and adhered to such beliefs, especially during the course of the terrible and practically continuous persecutions and sufferings to which they were subjected during the medieval period. Often these apocalyptic hopes, the belief in the speedy coming of the Messiah, the hope in the final triumph of the good and of justice, were the sole support of the Jewish people in their almost unbearable misery and wretchedness.

A. SH.

**BIBLIOGRAPHY.**—Charles, *Apocrypha and Pseudepigrapha of the Old Testament*, 1913, vol. 2, introduction; vol. 2, pp. 163-624 (the chief apocalypses, with commentary and complete English translation).

**APOCRYPHA, THE**, the name given to ancient writings related to books and characters of the Bible, which have not been received into the canon of Holy Scripture. It is derived from the Greek and means hidden and difficult to comprehend. Many of them are spurious and anonymous. Although found in part in the Septuagint and the Vulgate, they were not part of the Hebrew Bible. Early editions of the King James Version contained the Apocrypha proper, and the Douay Version retains them. The Apocrypha proper includes the following: I and II Esdras, Wisdom of Solomon, Ecclesiasticus, Tobit, Judith, Baruch, I and II Maccabees, The Prayer of Manasses, Song of the Three Children, History of Susanna, Bel and the Dragon, and additions to the Book of Esther. In addition to these are the following: Testament of Adam, Jubilees, Testament of the Three Patriarchs, Testament of the Twelve Patriarchs, Apocalypse of Abraham, Aseneth, Testament of Job, Testament of Solomon, Contradictio Salomonis, Jasher, Apocalypse of Elijah, Noah, Lamech, Og, Penitence of Jannes and Mambres, Book of Enoch, Secrets of Enoch, Ascension of Isaiah, Psalms of Solomon, Lamentations of Job's Wife, and Psalm 151.

In the New Testament Apocrypha there are found many books of both Jewish and Christian origin, some written by orthodox believers and others by heretics. Some have an historic and religious value and were much esteemed in the medieval centuries. They have been classified as follows: (1) Apocryphal Gospels of orthodox origin: The Proto-evangelium Jacobi, the Pseudo-Gospel of Matthew, Arabic Gospel

of the Infancy, Gospel of Gamaliel, and the Evangelium Joannis. (2) Heretical Gospels: Gospel according to the Hebrews, Gospel according to the Egyptians, Gospel of Eve, Gospel of Judas Iscariot, and seven Gospels according to Thomas, Bartholomew, Peter, Barnabas, Thaddeus, Matthias and Andrew, some of which are only known by name. (3) Pilate literature: Narrative of Joseph of Arimathea, Acts of Pilate, or Gospel of Nicodemus, Report of Pilate to the Emperor and the Letters of Jesus and Abgar, king of Edessa. (4) Pseudo-Acts of the Apostles: Acts of Simon and Jude, Acts of Peter and Paul, Acts of Xanthippe and Polyxena, Acts of Peter, Acts of Barnabas, Acts of Mark, Acts of Luke, Acts of Timothy, Teaching of Addai, Preaching of Peter, Acts of Matthew, Preaching of Paul, and the Teaching of our Lord Jesus. (5) Epistles: Epistle to the Laodiceans, Third Epistle to the Corinthians, Epistle of Mary to Ignatius Martyr, Epistle of Mary to the Florentines, Epistle of Mary to the Messanienses, and the Letters of St. Paul and Seneca. (6) Apocalypses: In addition to a Pseudo-Apocalypse of St. John, there are three named for Mary, Peter and Paul. The following, sometimes included in the Apocrypha, really belong to the patristic writings: Shepherd of Hermas, Teaching of the Twelve Apostles, Epistle of Barnabas, and the Apostolic Canons and Constitutions. Some of the more important books of the Apocrypha are treated separately under their own names.

**APOGEE**, that point of the moon's orbit which is furthest away from the earth.

**APOLLO**, a Greek god, was the son of ZEUS and LETO. Pursued by her rival, HERA, Leto took refuge on the island of Delos, where, under a palm or olive tree, she gave birth to APOLLO and his twin sister, ARTEMIS. Apollo was fed with ambrosia and nectar. Stimulated by this divine food, he demanded a lyre



APOLLO AND ARTEMIS

and a bow, and so enraptured was the island that it decked itself with golden flowers. Apollo became the god of judgment and prophecy (see DELPHI). He was also patron of music, inventing the flute. By playing on the lyre, he built the walls of Troy. Apollo has been identified with HELIOS, god of the sun. Sculptors regarded Apollo as the ideal of manly beauty. The most famous of his statues is the Apollo Belvedere in the Vatican.

**APOLLO BELVEDERE**, one of the most notable statues of antiquity, discovered at the end of the 15th century near Grottaferrata. It was placed in the Belvedere gallery of the Vatican at Rome, where it now stands. It represents Apollo in an animated attitude, his restored left hand holding part of a bow. This statue, an imitation of a Grecian bronze, probably was made at the beginning of the Empire.

**APOLLODORUS OF DAMASCUS**, a Greek architect who lived during the second century A.D. According to Procopius, he superintended the works undertaken by the Roman emperor, Trajan (97-119 A.D.), including the Forum of Trajan at Rome, a bridge across the Danube, and the triumphal arches



APOLLO BELVEDERE  
In the Vatican, Rome

at Beneventum and Ancona. He also served Hadrian, Trajan's successor, for whom he wrote his *Poliorceticus*, a treatise on engines of war. He was put to death by Hadrian for criticising that emperor's plans for a temple.

**APOLLONIUS OF RHODES** (c. 295-215 B.C.), Greek poet and grammarian, was born at Alexandria, about 295 B.C. He was exiled and settled at Rhodes, where he had a school of rhetoric. He was a pupil of Callimachus. Later he was recalled to Alexandria and became librarian of the museum. He died at Alexandria in 215 B.C. His chief poem was an epic in 4 volumes called the *Argonautica*, based on the legend of the Argonauts.

**APOLLONIUS OF TYANA** (1st century A.D.), a Greek philosopher, was born shortly before the beginning of the Christian era, at Tyana in Cappadocia. He studied and preached at Tarsus and attracted a considerable following. He taught the doctrines of Pythagoras. He claimed prophetic vision and was said to have performed miracles. He traveled through Nineveh, Babylon and India, absorbing the eastern philosophy, journeyed to the west and was received at Rome. He was accused of plotting against Nero and Domitian but escaped trial. Sometime later he opened a school at Ephesus, where he is believed by some authorities to have died at the age of 100.

**APOLLYON**, the angel of the bottomless pit mentioned in Revelation 9:11, whose name is given as the equivalent of the Hebrew *Abaddon*, meaning destruc-

tion. He has been made familiar to the world at large chiefly by John Bunyan. In *PILGRIM'S PROGRESS*, Apollyon engages Christian in a terrible conflict and is described as "clothed with scales like a fish. He had wings like a Dragon, feet like a Bear, and out of his belly came Fire and Smoke, and his mouth was as the mouth of a Lion."

**APOLOGETICS**, a term defining that branch of theology which undertakes to explain and defend the Christian faith. The word, used in the strictly Greek sense, implies no surrender of, or apology for, belief. The apologies of Socrates, Aristides and Newman are to be described, rather, as rejoinders.

**APOLOGIA PRO VITA SUA**, the religious autobiography of JOHN NEWMAN, published in 1864 and recounting the inner course of the cardinal's conversion to the Roman Catholic Church.

**APOMORPHINE**, a grayish alkaloid, obtained from morphine by extraction of a molecule of water. It is generally marketed in the form of Apomorphine Hydrochloride ( $C_{17}H_{17}O_2NHCl \cdot \frac{1}{2}H_2$ ), used chiefly to promote vomiting. Prescriptions for apomorphine must conform to the provisions of the Harrison Narcotic Law even though the preparation as used is not habit forming.

**APOPLEXY**, a sudden stroke of paralysis and coma brought on by rupture of a blood vessel in the brain, due to arteriosclerosis or other conditions. The pressure of the suddenly formed mass of blood within the rigid cranial cavity causes general pressure on the brain, so that consciousness is lost and the vital functions are dulled. The face is flushed, the pupils are dilated, the breathing slow and noisy, and usually accompanied by a flaccidity of the cheeks and lips, with the cheeks blown out during expiration. The pulse is generally slow and the temperature normal, though often subnormal.

In severe cases death may occur in several hours, or the patient may slowly regain consciousness, with remaining paralysis of one or more extremities and loss of speech. The paralysis is on the side of the body opposite to the hemorrhage, as the nerve tracts cross before termination in the muscles.

Various functions and regions may be affected, depending upon the locality of the brain over which the hemorrhage lies. There is gradual improvement as the blood is absorbed and pressure is removed. Some incapacity usually remains and the chances of recovery depend upon the extent of the damage.

Persons stricken with apoplexy should be placed in bed and allowed to remain there for some weeks. Rest should be the guiding principle in treatment. The skin needs great care if bedsores are to be prevented. Later, use of the muscles should be encouraged. Recurrences should be guarded against by moderation in the mode of living and rest. See also **BLOOD PRESSURE**; **PARALYSIS**; **THROMBOSIS** AND **EMBOLISM**. W. I. F.

**APOSTASY**, a religious term signifying a renunciation of faith or other obligation by a definite act or word. In the Catholic Church a monk or priest who

abandons the house he belongs to is held to be an apostate. See **JULIAN**.

**APOSTLE**, from a Greek word meaning to send forth, and hence a missionary. It was the title conferred on the Disciples by Jesus, when he sent them forth to preach and heal. As used by the Church in later years, it was limited to the earliest preachers of the Christian Gospel, or to those who were commissioned by Jesus, including St. Paul; and implied the exercise of certain functions, such as the "laying-on of hands" and the appointment of Church officers. In more recent centuries, it has been conferred popularly on saints, missionaries and even on advocates of various reforms, as for instance St. Francis Xavier, "the Apostle of the Indies," José de Anchieta, "the Apostle of Brazil," John Eliot, "the Apostle of the Indians," St. Cyril, "the Apostle of the Slavs," or Richard Cobden, "the Apostle of Free Trade."

**APOSTLE SPOON**, a silver or silver gilt spoon with a figure of one of the apostles on the handle. The apostle spoon in England was the customary gift for a sponsor to give a godchild at the christening. The wealthy gave a set of 12, and, rarely, 13 on which one had the figure of Christ. The apostle spoon was popular during the 15th and 16th century. There is a reference to it in Shakespeare's *Henry VIII*; the king asks Cranmer to stand godfather to the princess and, when Cranmer hesitates, the king says, "Come, come, my lord, you'd spare your spoons."

**APOSTOLIC CANONS**, a very ancient compilation of 85 rules for the ordering of the Christian clergy. See **APOSTOLIC CONSTITUTIONS**.

**APOSTOLIC CONSTITUTIONS**, the name of eight books, said to have been authorized by the Apostles and communicated to the Church by Clement, Bishop of Rome, about 90-100 A.D. To these important documents in their present form, scholarship assigns a later date in the 4th century. They are held to be not apostolic in direct origin but a compilation of great historical and ecclesiastical value, based mainly on the custom and views of the Christian community as it developed within the Graeco-Roman civilization. The last of the eight books contains 85 rules, or apostolic canons, for the ordering of the clergy.

**APOSTOLIC FATHERS**, a term indicating the Christian writers of the 1st and 2nd centuries, who were in touch with or directly influenced by the original twelve Apostles. The list includes among others CLEMENT I, Ignatius of Antioch and Polycarp of Smyrna.

**APOSTOLIC SUCCESSION**, the doctrine that a bishop receives his consecration as a spiritual and ecclesiastical successor of one of the twelve Apostles.

**APOSTOLICI**, a name applied to four sects, all of which aimed at the Christian simplicity of the apostolic period. In the 3rd century the movement, appearing in Asia Minor, was ascetic, and adherents were forbidden to marry or hold property (comp.



I Tim. 4:3). Secondly, we have a young artisan, Gerard Segarelli of Parma, selling his house and giving the price of it to the poor. He appeared in a white cloak and gray robe about 1260, letting his beard and hair grow long, and adopting the sandals and cord of the Franciscans, to which order he had failed to secure admittance. Among the common people, he had a great following which included Germans and English. In 1286 Pope Honorius ordered the Apostolici to obey some rule of life, recognized by the Church. They refused and were repeatedly condemned, as for instance, Würzburg in 1287, and Chichester in 1289, to banishment and persecution. In 1291 they were joined by Dolcino of Novara who, after three recantations before the Inquisition, entrenched himself in the mountains near Vercelli, claiming Messianic prestige. In 1305 Pope Clement V proclaimed a crusade against the rebels who resisted for nearly two years. During a whole day, Dolcino, when captured, was torn in pieces by red hot pincers. A third movement in the 12th century spread from COLOGNE and PERIGUEUX in France. These sectaries denounced marriage, the use of flesh meat, and the priesthood, declaring that any believer is entitled to celebrate the sacrament. Also they condemned veneration of saints, prayers for the dead and oaths, insisting that they were not found in the teaching of Christ and the Apostles. Two of these schismatics, after being allowed three days for reflection, were burned alive as anarchists at Cologne. Fourthly, we have the extreme ANABAPTISTS who, interpreting Scripture literally, practiced poverty, and by accepting the duty of washing the feet of others, were known as Pedonites. It is as forerunners of the Reformation that, historically, the Apostolici are significant.

**APOSTROPHE**, addressing some person or thing under discussion as though he or it were actually present, i.e., "Lafayette, we are here!" Except in consciously humorous passages, it is a dangerous device unless strong emotion and elevation of thought and language are present. When an abstraction is addressed, personification is also involved, as "O Death, where is thy sting?"

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**APOTHECARIES' WEIGHTS AND MEASURES**, a system of Weights and Measures used by druggists and pharmacists in compounding prescriptions. The unit of this system is the grain, or minim, 5,760 of which make one pound.

#### Apothecaries' Weight

20 grains or minims	= 1 scruple
3 scruples = 60 grains	= 1 dram or drachm
8 drams	= 1 ounce
12 ounces = 5,760 grains	= 1 pound

#### Apothecaries' Liquid Measure

60 minims	= 1 dram or drachm
8 drams	= 1 ounce
16 ounces	= 1 pint

**APOTHEOSIS**, the process of glorification whereby a man, either before or after death, receives divine

honors. (See ALEXANDER THE GREAT.) The Roman emperors were thus deified.

**APPALACHIAN MOUNTAINS**, the highland belt of eastern North America, extending from the Gaspé peninsula of Quebec southwestward through New England and eastern United States into Alabama. The system as a whole is complex due to the structural differences of its divisions but its unifying feature is the Great Appalachian valley which opens off the St. Lawrence lowland at the north and runs southwestward through the center of the belt. It is a great, wide corridor, the western side of which contains many linear ridges, but the eastern part is a valley drained by many different rivers. It is known successively as the Champlain lowland, the Hudson valley, the Kittatinny valley in northern New Jersey, the Lebanon and Cumberland valley in Pennsylvania and Maryland, the Shenandoah valley in Virginia, the valley of East Tennessee and in Georgia and Alabama, the Coosa valley. The ridges which diversify its western part reach their greatest width in Pennsylvania and are known as the Allegheny ridges. They belong structurally to that part of the highland belt west of the valley, which consists of the dissected edge of the Allegheny and Cumberland plateaus. Its northernmost portion is called the Catskill Mountains, the section in northeastern Pennsylvania is the Pocono Mountains, and the east-facing escarpment of the plateau is known as the Allegheny Front as far south as Kentucky and as the Cumberland Mountains for the remainder of the distance. North of the Catskills, across the Mohawk River valley are the Adirondacks.

East of the Great Valley, the highland belt to the north consists of the rugged New England upland containing such groups as the Berkshire Hills in Massachusetts, the Green Mountains of Vermont, the White Mountains of New Hampshire, and a chain of monadnocks running through Maine and New Brunswick and terminating in the Notre Dame Mountains of the Gaspé peninsula. The Hudson highlands of New York State cross the Hudson River, continue in New Jersey as the Ramapo Mountains, and die out near Reading, Pa. South of the Susquehanna valley the Blue Ridge begins and maintains a continuous crest east of the Great Valley as far as Georgia. It widens toward the south and in North Carolina has several spurs which run transversely to the general trend. Of these the Black Mountains contain Mt. Mitchell, 6,684 ft., the highest elevation in the Appalachians. The system generally has an elevation of from 3,000 to 4,000 ft.

**APPARITIONS**, the general name for subjective appearances, including lights and human forms. They are in so far HALLUCINATIONS occurring in the waking state, similar to the vivid impressions of dreams. Because of the widespread belief in the veridity of such appearances as a form of communication, they have been investigated by psychical researchers. In the typical case the apparition of X occurs to a relative or friend at the moment at which X is in danger or coincident with his death. The evidence is simi-

lar to that of the prophetic value of DREAMS. One of the early projects of the Society for Psychical Research was a census of such hallucinations or apparitions, which established that they were fairly common among normal persons.

That such apparitions occur in periods of emotional stress and among nervously sensitive persons is well known, likewise that they may be induced by drug action; while the association between fasting and visions is ancient. Psychic researchers are impressed by the VERIDICAL or fact relation between the appearance and an actual event occurring at a distance. They include phantasms of the living and of the dead. Those who believe in TELEPATHY would explain the former by that hypothesis, while the latter has been regarded as evidence of survival after death.

A large number of such apparitions which include specific details as of drowning or other accident, prediction of death, location of lost persons or objects, have proven to be false, that is, contrary to fact, thus indicating how frequently they occur to one disposed to such visions. Coincidence plays a large but incalculable part. The body of evidence, though loose and irregular, suggests more than an accidental relation. Most psychologists hold that they may be brought within the range of a natural explanation without resort to such hypotheses as telepathy, spirit return, supernormal powers, while admitting that many well-attested incidents yield no clue to their explanation.

J. J.

**APPEAL**, in law, the removal of a case from a court of inferior to one of superior, usually appellate, jurisdiction in order to review the proceedings of the lower court. In England before 1873 suits in equity were reviewed by appeal, but actions at law by writ of error. This distinction obtained originally in the United States by derivation from England. But in England by the Judicature Act, and by legislation very generally in the United States, appeals in the nature of error proceedings have been substituted for the writ of error, and the tendency is to review all judgments in every sort of proceeding by appeal. In the Supreme Court of the United States the writ of certiorari is used instead of appeals and writs of error and decrees in equity by appeal as in the old practice. In the states proceedings in magistrates' courts and probate proceedings are often reviewed by statutory appeals in which the case is removed to a court of general jurisdiction and there completely retried. For the rest, state statutes commonly provide for review of judgments and decrees of courts of general jurisdiction in an appellate court, either an intermediate appellate court, or ultimately the highest court of the state by an appeal in the nature of an error proceeding in actions at law, and by way of a technical appeal in proceedings in equity. The distinction is that an appeal (which is a proceeding of civil law origin) removes the whole case so that the facts and the law are passed upon *de novo*, whereas in an error proceeding the record is examined for errors of law appearing on its face.

**APPEARANCE**, a formal proceeding by which a party submits himself to the jurisdiction of a court. It may be general or special. A general appearance is an unqualified submission to the jurisdiction of the court, while a special appearance submits to the jurisdiction for some specific purpose only and not for general purposes of the proceeding.

**APPENDICITIS**, is an inflammatory infection of the vermiform appendix. It is bacterial in origin and may be caused by infection from intestinal contents, or from the blood stream secondary to an infection in another part of the body. Rarely it is brought on by a grape seed or other foreign body in the lumen of the appendix. Constipation, errors in diet, acute colds and infections may induce the inflammatory condition.

The first symptom is a generalized abdominal pain. The individual afflicted usually believes he has an acute digestive upset. Vomiting and nausea usually follow the onset of the pain. After several hours the pain becomes localized over the lower right quadrant of the abdomen. There is tenderness on pressure, and rigidity of the abdominal musculature of the right side. The temperature and pulse are not elevated to any considerable degree until the disease has become really dangerous. Laboratory examination of the blood reveals increase in number of white cells.

Appendicitis should always be suspected when the above symptoms are present. One should not wait for localization or should not take a cathartic, as the latter is likely to cause complications. A competent physician should be summoned, and operation agreed to without delay, if an operation is considered necessary. The operation is quite safe, but perforation, peritonitis, and death may be the result of a delayed decision. See also APPENDIX, VERMIFORM. F. C. W.

**APPENDIX, VERMIFORM**, a narrow pouch-like projection at the point of junction of the small and large intestine. Its average length is about four inches. It is composed of the same layers as the remainder of the alimentary canal, though it has more lymphoid tissue in its walls, and has no villi. In some mammals it forms a reservoir for digesting food, but in man is rudimentary and not functional.

**APPERCEPTION**, a phase of attention. The theory was introduced by Leibniz to account for the process by which perceptions become more clear. Perception, in the Leibnizian psychology, occupies a middle ground between little perceptions which are too feeble to get over the threshold of consciousness and apperception which stands for that stage in which percepts have been wrought over and their meaning clarified by ideas. Apperception thus puts the emphasis on the activity of the mind in the knowledge process, and is contrasted with associationist psychology.

The theory was taken up by Herbart and its educational implications were developed by him. The little perceptions of Leibniz became the apperceptive mass of Herbart. Even in an ordinary act of perception

past experience is utilized in the interpretation of meaning. Apperception here represents the interaction between the presented stimulus and the organized content which the mind brings to bear upon it. Since apperception is involved in perception the term is more or less going out of use.

**APPETITE**, the desire to satisfy any need, either mental or physical. It is used specifically to indicate a desire for food. The smell or sight of food, or even thinking about it, will often start the appetite, probably by stimulating secretions of saliva and contraction of the stomach. Food that is disliked, unpleasant odors and tastes will take away the appetite, by arousing mental associations which inhibit these organic activities.

**APPIAN WAY**, the *Via Appia* of the Romans, was the famous highway between Rome and southern Italy, extending as far as Brundisium, the modern Brindisi. It was begun by the censor, Appius Claudius Caecus, in 312 B.C. Issuing from the Appian Gate, it proceeded through Aricia and through the Alban Hills and over the Pontine marshes to Tarracina, extending to Capua. Later construction brought the highway to Beneventum and finally through Venusia, Tarentum and Uria to Brundisium. The older road through Capua and Beneventum is still used and three of the old bridges remain. Horace describes a journey along the Appian Way, and it was by this road that St. Paul entered Rome. A new Appian Way from Rome to Albano was built by Pius VI.

**APPLE**, a tree of the ROSE FAMILY. The name is also used in combinations such as custard-apple, may-apple and pineapple which designate wholly unrelated edible fruits. Though various species of apples are native to the north temperate zone, the leading cultivated varieties trace their ancestry to the wild apples of western Asia and eastern Europe (*Pyrus Malus*, the apple; and *P. baccata*, the crabapple). These have been cultivated since prehistoric times, as evidenced by charred remains in the lake dwellings of Switzerland.

The *P. Malus* develops a round-headed tree with fuzzy, short-stalked leaves and rather dense clusters of woolly-stemmed flowers, as in most varieties; the *P. baccata* is a more wiry-growing tree with glossy, long-stemmed leaves and rather open clusters of long stalked flowers which are common in most crab-apples. The eastern states crabapple (*P. coronaria*), often grown for ornament, has produced no improved varieties, either direct or by hybridizing, but the prairie crabapple (*P. ioensis*) has been hybridized with the common apple and thus originated a race (*P. Soulardi*) of which the Soulard, noted for its extreme hardiness which favors its being grown in cold sections, is the best known variety.

Several thousand cultivated varieties have been listed. Some of them are grown in temperate climates of both Northern and Southern hemispheres, especially in the United States, Canada, Australasia. They are probably the most important fruits of the world. In

America the fruit is cultivated in nearly all the Canadian provinces and the entire United States, though not extensively grown in those states bordering the Gulf of Mexico nor in the hot parts of western states, where seasonal conditions are unfavorable except in the higher altitudes.

#### APPLE PRODUCTION, U.S.

5-Year Average, 1926-30

Division	Production (Bu.)	% of Total
UNITED STATES . . . . .	172,705,000	100.0
LEADING STATES:		
Washington . . . . .	32,045,000	18.5
New York . . . . .	24,016,000	14.0
Virginia . . . . .	12,660,000	7.3
California . . . . .	10,087,000	5.8
Pennsylvania . . . . .	9,561,000	5.5
West Virginia . . . . .	6,834,000	4.0
Michigan . . . . .	6,195,000	3.5

On this continent several commercially important regions specially adapted to apple growing have developed and taken as a whole constitute the most important apple growing area of the globe. The region longest established extends from Nova Scotia to Massachusetts and westward to Michigan. In this section productiveness, longevity of the trees, high quality and long keeping attributes of the fruit reach their zenith. A second section is the Piedmont and highland area of Virginia, West Virginia and adjoining states. Other important though younger areas are the Ozark region, inter-mountain districts between Montana and New Mexico and various favored localities from British Columbia to California. It is estimated that the total yield of this area in maximum years approximates 200,000,000 barrels. The U.S. census reports the yield for 1909 as 145,412,000 bu.; for 1919 as 136,551,000 bu.; for 1929 as 142,488,000 bu.

Varieties of apples differ widely in many ways: In adaptability to regions, southern varieties (Bonum) failing in the North and northern kinds (Baldwin) failing in the South; in adaptability to soils, those suited to limestone land (Yellow Newtown) being inferior in sandy ground and those suited to light soils (Gravenstein) less excellent on heavy soils; in the length of time before they begin to bear, Oldenburg in 2 or 3 years, Esopus in 9 or 10; in season of ripening from July in the North for Early Strawberry to April in natural storage for Winesap; in utility, some for culinary purposes only (Fallawater), others for dessert (Jonathan), and still others to general purposes (Fall Pippin); in texture from the juicy Fameuse to the mealy Rome; and in size from the diminutive Pomme Grise, weighing only 2 or 3 oz., to the coarse, giant Gloria Mundi, whose record specimen weighed more than 2 lbs. and sold at auction for £14 (about \$70) in London, England, in 1913.

Practically all varieties grown in America are of American origin. Some, such as Baldwin, Primate, Northern Spy, McIntosh and Wealthy, are of such outstanding merit that tablets and monuments have been erected on the sites of the original trees.

In addition to the enormous quantities of apples cooked in countless ways and eaten raw, the fruit is used commercially for canning, jelly making, apple butter, drying, beverages, such as cider, juice, wine and brandy, and vinegar making. Considerable quantities of both dried and raw apples are exported, mainly to Europe and South America.

Since apple varieties almost never reproduce their varietal characteristics when grown from seeds, they are propagated by grafting and budding. These methods enable nurseries to develop trees of salable size and known varieties after only one season's growth and to guarantee that the trees will produce commercially important fruit. Apple varieties are dwarfed by grafting or budding them on Doucin or Paradise apple stocks. These are naturally dwarf varieties which insure small size of tree without reducing the size of the fruit grown. In Europe such trees are popular in home gardens either as large bushes or trained against walls or on trellises in various ways. In America they are little used.

Provided other conditions are suitable, apples thrive on any well-drained soil that will grow good crops of wheat, corn or potatoes. Rolling or elevated lands are generally preferable to low sites for orchards because less likely to be frosty during the blooming period. In some sections fall planting is preferred to spring; in others, the reverse. For commercial purposes apples are not planted among other fruits, except as noted below, mainly because of differences of handling.

Most varieties of apple trees grow large and it is advisable to set them at least 40 ft. apart each way. This distance permits the growing of peach trees as fillers midway between the apple rows in each direction. Surface-feeding and low-growing crops such as strawberries, melons, tomatoes and cabbage may also be grown between the trees for two or three years. These crops are expected to pay the cost of tree tillage, rather than to pay of themselves. The peaches should do the same until about the eighth or tenth year, at which time the apple trees usually need the entire area. Small growing, quick maturing apple trees are sometimes set as fillers between the slower growing, wider spreading permanent trees. Many growers, however, consider this practice dangerous to the permanent trees because the fillers are allowed to remain too long before being cut out.

Although several thousand European and American varieties have been described and although the composite list offered by nurserymen includes about a thousand, scarcely a hundred of these are of commercial importance, the principal ones being winter varieties. Before the advent of the auto truck few growers planted as many as ten kinds on a commercial scale, most of them less than five. As the truck can go direct from orchard to city and permits the shipment of smaller lots than carloads, wider assortments are being planted because, with varieties ripening successively from mid-summer onward it is more feasible to keep a smaller force of pickers busy con-

tinuously than to secure the large numbers of men needed to harvest immense quantities of winter apples during the few weeks in which they must be handled.

Apples suffer from many injurious insects and fungous diseases but these may be kept under control by preventive methods of spraying and dusting.

M. G. K.



**APPLE-BORER**, the name given to two beetles, *Chrysobothris femorata*, the flat-headed borer, and *Saperda candida*, the round-headed borer, which infest apple trees. The eggs of both species are laid in cracks in the bark during the summer, and hatch into yellowish grubs which eat through into the sapwood. In the spring the adult flat-headed borers emerge from the pupae as small, olive-gray beetles with blunt heads, and the round-headed species turns into a cylindrical brown beetle with a conspicuous white stripe down its side. This latter species lays its eggs near or under the surface of the ground. The presence of the borers is indicated by darkened bark and coils of sawdust-like particles adhering to the tree, or on the ground.



**APPLES OF SODOM**, fruit described by ancient writers as of beautiful appearance but dissolving into smoke and ashes when plucked. Jean de Thévenot, the French travel author, writes of strange apple trees growing along the shores of the Dead Sea; hence, the term Dead Sea Fruit. Josephus, Strabo and Tacitus speak of them and are doubtless referring to the gall nuts produced by the sting of the insect *Cynipis insana*. The small, yellow tomato-like fruit of the spiny shrub *Solanum Sodomoeum* are frequently called Apples of Sodom. The phrase is also used figuratively for anything disappointing.

**APPLETON**, a city in eastern Wisconsin, the county seat of Outagamie Co., situated on the Fox River, 88 mi. northwest of Milwaukee. Bus lines, lake and river craft and three railroads afford transportation. There is an airport. Dairy products are marketed in the city, which has various industries, including pulp and paper making and the manufacture of iron and lumber products. Lawrence College, founded by a Boston merchant in 1846, is located here. The city is attractively situated on the bluffs of the river. Lake Winnebago is immediately southeast. Appleton was founded in 1846. The village was incorporated in 1853, the city being chartered in 1857 in consolidation with two other villages. Pop. 1920, 19,561; 1930, 25,267.

**APPLE-WORM**, the larva of the CODLING MOTH. This is the pinkish white caterpillar commonly found in wormy apples. Larvæ of the second brood are most destructive. Widely distributed, and a serious pest.

**APPLIED MECHANICS.** See MECHANICS.

**APOGGIATURA**, in music, a grace note virtually identical with the acciaccatura (literally, "crushed note"), save that it is longer. It is derived from an Italian word meaning "leaning." The long appoggiatura is written thus  and played thus ; the

short (or stroked) appoggiatura is written thus  and played thus .

**APPOMATTOX COURT HOUSE, SURRENDER AT**, Apr. 9, 1865, the capitulation of the Confederate Army of Northern Virginia to the Union forces under Gen. Grant. Gen. Lee on Apr. 3, directed the evacuation of Richmond, capital of the Confederacy. The city was occupied by a Federal corps under Gen. Weitzel while the greater part of Grant's army pursued the retreating Confederates. The failure of expected supplies to arrive at Amelia Court House left the Confederate troops without foodstuffs. The supply trains were seized by Union cavalry at Appomattox Station on Apr. 8, and on the following day Gen. P. A. Sheridan's Federal troopers barred the road before Lee's column. Lee then acceded to the protestations of his staff that surrender was inevitable, and at the house of one McLean in the village of Appomattox Court House arranged terms with Gen. Grant. Casualties, losses by capture, and desertions had reduced the surrendered army to 26,765 men. The terms of capitulation were surrender of arms, parole for all officers and men until exchanged, retention of side-arms and privately owned horses and mules by the Confederates. The capitulation of Confederate commands elsewhere in the South followed upon the news of Appomattox. In all 174,223 troops were paroled after surrender on the terms offered the Army of Northern Virginia.

**APPONYI, GEORGE, COUNT** (1808-99), Hungarian statesman, was born Dec. 29, 1808. He was the leader of the conservative nobles in the Pressburg Diet and becoming Hungarian court chancellor in 1846, he reorganized the administrative system. Not in sympathy with the revolutionary movement of 1848, he advocated in the Reichstag the restoration of the Hungarian Constitution. In 1861 Apponyi was appointed royal commissioner at the Diet at Budapest and leader of the moderate party in the Upper House, supporting Deak's struggle for an autonomous Hungary. He died Mar. 1, 1899.

**APPORTIONMENT**, in political parlance, the process of allotting representatives or taxes on the basis of population. The Constitution of the United States specifically provides that both representatives and direct taxes—the INCOME TAX excepted—shall be apportioned among the several states according to their respective population. A census, taken every ten years, forms the basis of such reapportionment. The actual redistribution of seats within the states remains vested in the legislative body of the various states. The problem of apportionment, however, is not confined to the national government but exists equally in connection with the allocation of seats both in state legislatures and in municipal councils.

**APPRAISEMENT**, valuation of property, either through legal procedure, or by agreement of the interested parties. The statutes usually regulate the legal

procedure. Best-known examples are the valuation of merchandise in connection with customs duties, the valuation of a decedent's estate, and of property taken for public use under eminent domain. In unofficial appraisements by agreement, the decision is final. The person making the appraisal is called an appraiser.

**APPREHENSION**, a simple act of intellection. It is immediate and simple as contrasted with complex knowing processes. In various systems of psychology it has been regarded as a phase of intuition. The opposite of apprehension is comprehension, which involves more elaborate processes. Apprehension is sometimes said to be so immediate and direct as to fall outside the realm of truth and error. These involve judgment and apprehension is much too simple for that. The meaning is also clearly shown in the distinction between "knowledge about" and "acquaintance with" a thing. It is the "acquaintance with" that is apprehended, "knowledge about" standing for a much more circuitous mental route.

**APPRENTICESHIP**, a method of training craftsmen, under which the learner is taught the trade by one already in it, his instruction being paid for wholly or partly by work. As a system it flourished during the era of GUILD control of industry, by 1400 becoming a necessary prerequisite to guild membership. The master furnished instruction and the necessities of life; the apprentice was bound to good behavior. The guilds adopted stringent regulations for apprenticeship in order to insure high quality in the personnel of a given craft. An applicant's birth, character and previous training were carefully scrutinized before his contract of indenture might be signed by the master. The period of apprenticeship varied from two to 12 years, seven being the normal. The number of apprentices allowed a master was regularly limited, the object being to secure good technical training as well as to limit competition. The growth of the factory system and the increasing specialization of labor made apprenticeship impracticable in most trades, but it still flourishes in Europe, especially in less highly industrialized communities.

Recently, in the United States, the more practicable phases of apprenticeship have been revived, due to the need for more thoroughly trained workers and for regulation of their training. Apprenticeship training is now given by employers, trade unions (*see* LABOR ORGANIZATIONS), or by these two groups jointly. The entrance age is usually 16 to 18 years, the period of training varying from two to four years. In some cities schools are cooperating to correlate school training with job training. There are also CONTINUATION SCHOOLS where juveniles receive training in their trade or a desired trade for a few hours each week.

**APPROPRIATION** by a government is the setting aside and designation of money for a particular purpose by the duly constituted appropriating authority. This agency in most modern countries is the legislature. In the United States all bills for the appropriation of money must originate in the HOUSE OF REPRESENTATIVES, although they may be drastically

amended by the SENATE. A similar restriction is to be found in many of the states. During the last quarter of a century an attempt has been made to throw greater safeguards around the appropriation of public money by a carefully worked out BUDGET procedure.

In the British government, the ministry originates proposals for the expenditure of funds, which the House of Commons considers, but its powers are restricted to the reduction of appropriations. In France the lower house initiates the budget. The minister of finance in Germany has special powers in preparing estimates and with the chancellor's support can veto requests of his colleagues. S. C. W.

**APPURTENANCE**, in law, something that goes with, or is attached to a larger or more important object, commonly used of things which pass with a conveyance of land. For example, harpoons and all the outfit of a whaling ship, are appurtenances. In certain plants which require reservoirs in connection with their work, these reservoirs have been held to be appurtenances within the meaning of the MECHANICS' LIEN LAW, on the ground that they are part of the main structure and without it the plant would be useless. See also EASEMENT.

**APRICOT**, round-headed trees of the rose family whose edible fruit is intermediate between the peach and the plum. They are thought to be native to China but were brought to Europe during the reign of Alexander the Great. Two important species are cultivated: the common apricot of Europe and America (*Prunus Armeniaca* or Armenian plum) with smooth red or yellow, fragrant, sweet, firm flesh and the Japanese apricot (*P. Mume*), grown for its fragrant flowers.

Because of the early blossoming habit of the apricot, its flowers or its newly formed fruits are often destroyed by spring frosts, thus the tree is planted to only a limited extent in the eastern United States although it is often seen in home gardens. In the South, conditions are more favorable but as yet it is not planted there on a commercial scale. In California and Oregon it is grown extensively both for consumption as a dessert fruit and for drying and canning.

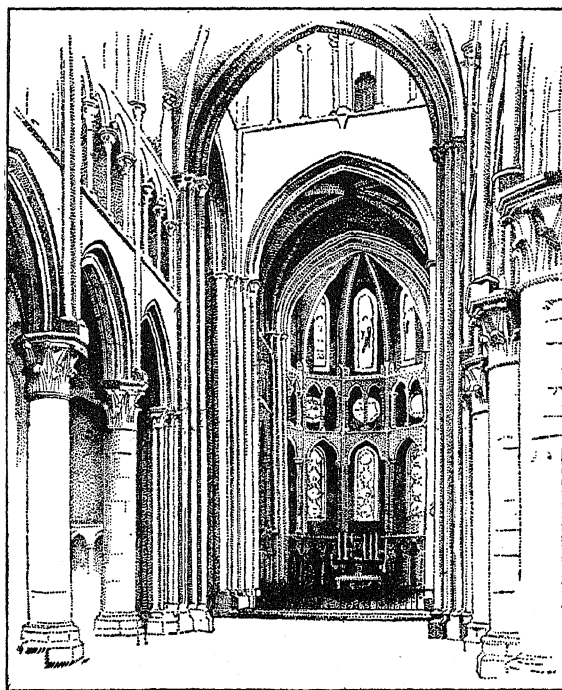
The apricot tree is as hardy as the peach so may be planted with confidence wherever the peach succeeds, but it prefers much heavier though well-drained soil such as most apples enjoy. If possible it should be planted on the northern or western side of a building so as to be shaded from the sun in the early morning. This tends to retard the opening of the flowers. For the same reason, an apricot orchard planted on a northern or western slope is better than one facing east or south. M. G. K.

**A PRIORI**, a mode of thought not based on experience, in opposition to a *posteriori* which means according to or derived from experience. An *a priori* argument is one based on deductive reasoning, the premises and conclusions of which cannot be verified by experience. The argument that God exists because existence is a part of the very idea of God is a case in point. With the development of modern

science the *a priori* method has fallen more and more into disrepute. The term is now used derisively to discredit any procedure which hints at scholasticism; it is the opposite of experimental.

The *a priori* has a special meaning in the philosophy of IMMANUEL KANT, with whom the term is frequently associated. When he speaks of the *a priori* element of experience, Kant means that part of our knowledge which is not in itself derived from experience, but is necessary to it and makes it possible. The categories, of which substance and causality were especially important, were thus considered as necessary to experience in that they made knowledge possible. They could not, however, be derived from experience; hence their *a priori* nature. See CATEGORY.

**APSE**, a semi-circular recess crowned with a half dome, particularly at the end of the nave or aisles of a church; hence, any circular or polygonal recess as the end of a motive or vista. The word is occasionally used even for a square chancel ending. The apse appeared in Roman temples, for example, in the Tem-



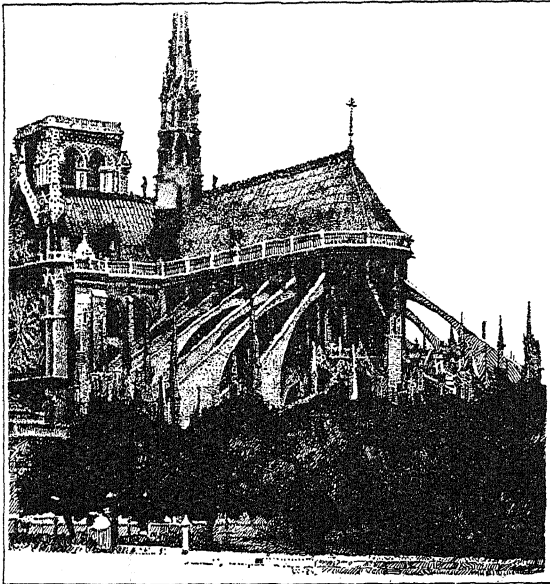
APSE, NOTRE DAME CATHEDRAL, DIJON, FRANCE

ple of Venus and Rome at Rome, about 115, as an enlarged niche at the end of the cella built to give an impressive setting for the cult statue. It was also an important element of the Roman basilica where its floor was often raised; in the apse sat the judges or officials. In early Christian basilicas at Rome, the apse appeared in a highly developed form. At first, as in the old St. Peter's, it was at the west end. In front of it was the altar, and around it ran marble benches for the clergy, with the bishop's throne in the center, as in the cathedral at Torcello, near Venice,



or the 6th century Cathedral at Parenzo, in Dalmatia. Eventually not only was the earlier orientation changed, so that the apse was at the east end of the church, but also the building of large CHoirs enabled the clergy to be removed from the apse. The altar was pushed further and further back, until in the later Renaissance it was sometimes against the wall.

In early Romanesque times complication of ritual led to the necessity for subsidiary altars. These were



APSE OF NOTRE DAME CATHEDRAL, PARIS

often placed in minor apses, either at the ends of the side aisles, as in Santa Maria Cosmedin, Rome, 8th century, or San Ambrogio in Milan, 9th century, where the arrangement is called tri-apsidal, or on the east sides, or even the ends of the transepts. In the Romanesque churches of the Rhine, it was customary to have two main apses, one at each end of the church.

**APSIDES, LINE OF**, the name given to the major axis, or longest diameter of the orbit of one celestial body around another.

**APTERYX** or **KIWI**, a flightless bird of New Zealand, called Kiwi by the Maoris from its whistling scream of "Ki-wi." The kiwi is like a long-billed chicken which has lost its wings and tail, and is clothed in a coat of brownish, hairy feathers. It has stout legs which, when defending itself, it uses vigorously. There are five or six forms of the Kiwi in different parts of New Zealand, ordinarily described as distinct species. The kiwi has been classed with the ostriches, emeus and other very large flightless birds because it has no keel on the breast bone. But it is probable that this is due, not so much to kinship, as to the fact that the disuse of the wings has led to the shrinking of the strong flight muscles and of the keel to which they are anchored. The huge extinct moas of New Zealand were probably related to the kiwi. Kiwis hunt for worms and vegetable shoots by

night or in the twilight. They have nostrils near the end of the long bill, and possess a keen sense of smell and hearing but have poor powers of sight. The female is larger than the male and has a deeper voice. She lays two very large white eggs in a burrow, but they are hatched by the brooding male, who takes sole charge for five or six weeks. In spite of their sturdy legs the chicks are at first unable to stand. While the kiwi has completely lost the power of flight, it is not quite "wingless," as its name apteryx suggests. Parts of the bones of the wing remain, though they are quite useless. Stewart Island, at the extreme south of New Zealand, has been made a bird sanctuary in which the kiwis are likely to find a permanent home.

C. J.

**APULEIUS, LUCIUS** (2nd century), Latin satirical author and philosopher, was born about 125, at Madura, northern Africa. He was well-educated, having studied at Athens and elsewhere, and also was widely traveled. His principal work, the *Metamorphoses*, or *GOLDEN ASS*, tells of a man who is transformed into an ass by magic and goes through all sorts of adventures. A Latin classic, it has been the inspiration of many later authors, including CERVANTES. As a philosopher Apuleius wrote several minor works, among them *On the God of Socrates*. The place and date of his death are not known. See also LATIN LITERATURE.

**APULIA**, an ancient district in southeastern Italy on the Adriatic Sea between Picenum and Calabria, in modern times one of the divisions of the Kingdom of Italy. It was settled by Samnites. The *Tabula Bantina*, found at Bantia, show that Oscan was spoken. Teate was one of the first towns. The earliest Latin colonies were Luceria, a military post, and CANUSUM. The main highways were the Via Appia and the Via Traiana. The battle of CANNÆ was fought in this territory. After Hannibal's overthrow, Apulia was subject to Rome. Augustus included Apulia and Calabria in his Regio II. The Lombards took the territory in 668. In 1043 the Byzantine Empire lost the region to the Normans. In 1734 it became a part of the Kingdom of the Two Sicilies. In 1861 Apulia was made a part of Italy. The province of Apulia has an area of 7,376 sq. mi. and comprises the departments of Bari, Brindisi, Foggia, Lecce and Taranto. Bari, Brindisi, Taranto and Barletta are the principal towns. Its inhabitants are engaged in fishing, wine-making and raising domestic animals, grain, olives, lemons, oranges and almonds. Salt mines and chemical works also afford considerable industry.

**APULIAN POTTERY**, an ancient Italian ceramic produced in Apulia during the 4th century B.C. The clay was dull brown in color and was made chiefly into vases and funeral urns. These were heavily



COURTESY M. M. OF ART

APULIAN CUP

ornamented, the decoration being florid in design and very brightly colored. The vase itself was frequently extravagantly shaped and as a rule was decorated on one side only, the reverse being filled in with conventional patterns of ornamentation. The best pieces of Apulian pottery are the funeral vases which depicted funeral scenes in white-painted ornamentation.

**APUS** (gen. *Apodis*), the bird of paradise, one of a number of small, inconspicuous constellations near the south celestial pole. See *STAR: map*.

**AQUA.** See *WATER*.

**AQUA AMMONIA.** See *AMMONIA*.

**AQUA FORTIS**, a name, meaning strong water, applied to a weak and impure *NITRIC ACID*. It is made in different strengths, as single aqua fortis and double aqua fortis, the latter containing twice as much acid as the former. "Aqua fortis" was early applied to nitric acid because of its active properties.

**AQUAMARINE**, a variety of the *BERYL*, other forms of which are the *EMERALD*, golden beryl and *MORGANITE*. The aquamarine is transparent and of a blue- to sea-green color, its appeal lying principally in the coloring, as none of the beryl gems have much fire or brilliancy. A peculiarly liquid clarity characterizes the aquamarine. It is sometimes found in large crystals, one from Brazil having weighed 245 pounds. Beryl is a beryllium aluminum silicate, crystallizing in the *HEXAGONAL SYSTEM*. Varieties other than the emerald occur almost exclusively in granite *PEGMATITES*. Aquamarines are found on the island of Elba, in Madagascar, Ireland, the Ural Mountains, Brazil, Ceylon and India. In the United States they occur in Maine, Connecticut, North Carolina, Colorado and California. See also *GEM STONES*.

**AQUA REGIA**, a strong acid mixture of concentrated nitric and sulphuric acids in the proportions of one volume  $\text{HNO}_3$  to three volumes  $\text{H}_2\text{SO}_4$ . The alchemists named the mixture "aqua regia" (royal water) because it would dissolve gold. It also dissolves platinum and palladium and is a solvent for certain of the less soluble sulphides.

**AQUARIUM**, a small receptacle containing live marine or fresh water flora and fauna, or a building devoted to the collection and display of such underwater life. For many years, the term was applied chiefly to the decorative small collections of private homes, but the founding of the famous aquarium of Naples in 1872 inaugurated the modern era of scientific stations for the study of salt and fresh-water animals and plants. Present day public aquaria of importance include that at Brighton, England, the U.S. Bureau of Fisheries in Washington, the New York City Aquarium in old "Castle Garden" on the Battery, and the new Shedd Aquarium of Chicago, the largest and most advanced in the world.

The successful maintenance of the toy aquarium depends upon the proper balance between plant and animal life. Such a goldfish bowl or small tank requires clean water, frequently aerated, either by the addition of fresh water or by scooping up and pour-

ing back that already in the bowl. In the home aquarium, simple underwater plants, snails or other mollusks, and a few picturesque goldfish or sticklebacks comprise the usual collection. The snails keep the growing plants from choking the water; the plants consume the carbonic acid gas which the different forms of animal life give off, and restore to the water the necessary oxygen.

The ideal marine aquarium is situated near the ocean, a few feet above the high water mark. Such a public aquarium is in reality a zoological station, including as it does tanks for the display of ordinary and curious fishes, laboratories, library, and other scientific equipment. Among the activities of a typical public aquarium are the classification and labeling of new material, the exchange of information and specimens with other aquaria, a "hospital" for ailing fish, and the maintenance of a complicated system for pumping and aerating water and keeping an even temperature. In connection with such an institution as the Naples station or the New York Aquarium, maintained by the New York Zoological Society, small steamers, dredges and other vessels are kept busy supplying specimens from nearby waters and often engage in long voyages to collect rare examples of deep-sea life. Once the specimens are transported to the aquarium, often a task of considerable difficulty, they must be surrounded with conditions resembling as perfectly as possible their natural habitat. The water in the tanks must be absolutely pure, kept fresh by constant circulation and free from harmful bacteria. Show tanks require plate glass fronts and carefully placed lighting from above. Tanks for the breeding of delicate specimens have opaque sides and are rarely on exhibition. In some cases, large sea animals, such as seals or sea lions, are kept in pools and these also require expert care. Many marine aquaria also show fresh-water specimens. The purely fresh-water aquarium is less costly to establish and maintain.

Modern aquaria have proved of economic as well as scientific importance, permitting as they do a close study of the breeding habits, diseases and environmental conditions affecting fish used as foods.

**AQUARIUS** (gen. *Aquarii*), the water-bearer, the eleventh sign of the Zodiac, is best visible during October and November evenings. It possesses no stars brighter than the third magnitude but a large number of the fourth and fifth magnitude. Among its double stars, is Zeta Aquarii, composed of two stars of the fourth magnitude at a separation of 3" to 5"; while among the variable stars R Aquarii is especially noteworthy as it appears embedded in a nebula. Aquarius furthermore contains the large *PLANETARY NEBULA*, known for its appearance as the "Saturn Nebula." See *STAR: map*.

**AQUATIC PLANTS**, a group of botanically unrelated plants suited wholly or partly for growth in salt or fresh water. As generally and loosely applied it comprises all plants that grow in the water, whether submerged or not. But it is only in wholly sub-

merged aquatics as the common eel-grass or wild celery that we find the peculiar structural features of true aquatics. Due to submergence they have no mechanism for transpiration, derive all their oxygen and carbon-dioxide from the water, and generally have a weak and flaccid texture.

The fertilization of submerged aquatics is remarkable. Some of the pondweeds raise their inflorescence above the surface at the period. But eel-grass, the latic-leaf and many others accomplish it under water. In some of them the pollen is developed down near the bottom, develops a special buoyancy when ripe, and, after a brief journey to the submerged female flower, floats off to destruction.

Some aquatic plants have become serious pests. The common North American water-weed, after introduction into England, became "Babington's Curse" when it closed many slow streams and ponds to navigation. The WATER HYACINTH and WATER LETTUCE have choked up many tropical streams with their dense growth of thick spongy leaves. And many of the floating islands of the Amazon and the Nile originate from masses of aquatic grasses. N. T.

**AQUATINT** (L. *aqua*, water, and It. *tinta*, dye), a method of etching that produces the effect of an India ink or a water-color drawing. A copper plate is covered with a ground of resin which forms a grain ready to receive the drawing. This is followed by an intricate method of working with varnish and aqua fortis, requiring patience and judgment, until the proper result is obtained. Aquatinting is of French origin. In England, however, during the 18th and well into the 19th century, this medium was carried to a high degree of perfection in reproducing the works of many famous artists.

**AQUEDUCTS**, channels or conduits for conveying water to cities and towns. Aqueducts built more than 2,000 years ago are still carrying water to Athens and Rome. These channels were carried on an even grade on stone arches over valleys so that water could flow uniformly along their entire length. The invention and use of cast iron pipe, later of steel and in recent years of reinforced CONCRETE pipe, provides means of conveying water in closed conduits under pressure, so that modern aqueducts are not laid on a level grade, but over hills and under streams. The largest aqueducts are now generally constructed of masonry except at valley "crossings." American cities that have brought water through long aqueducts are Los Angeles from 235 mi. away; New York, 120 mi.; San Francisco, 154 mi.; Winnipeg, 98 mi.; and many others from 20 to 60 miles. In Australia, the Coolgardie aqueduct is 351 mi. long and the Apulian aqueduct in Italy when finished will be 152 miles long.

**AQUILA** (gen. *Aquilae*), the eagle, a brilliant constellation of the late summer sky, best visible upon early September evenings. Its brightest star Altair, *Alpha Aquilae*, forms a brilliant triangle with two other white first magnitude stars, Deneb and Vega. Altair is flanked on either side by a third magnitude star. South of Altair is the fourth magnitude star Eta,

a CEPHEID VARIABLE, 1000 times brighter than the sun; its light varies periodically in seven days. See STAR: map.

**AQUILA, PONTICUS** (2nd century A.D.), translator of Hebrew Scriptures into Greek, was born in Pontus in Asia Minor, of Gentile origin. According to Epiphanius, his *floruit* was during the reign of Hadrian (117-138 A.D.), to whom he is supposed to have been related and by whom he was entrusted in 128-129 with the rebuilding of Aelia Capitalina on the site of Jerusalem. Here he was converted to Christianity. Failing to comply with the rigid practices of the Apostolic Church, he was excommunicated; upon which he embraced Judaism and became a disciple of Rabbi Eliezer ben Hyrcanus and Rabbi Joshua ben Hananiah (1st and 2nd century) and, according to Jerome, also of Rabbi Akiba, who taught from 95 to 135. It was under these masters that he undertook the laborious task of a new translation of the Hebrew Scriptures into Greek, probably as a foil to the Septuagint which had received the sanction of the Church and was used for allegorical and christological interpretations. The aim of the new translation was on the one hand to obviate christological explanations of certain passages through a strict adherence to the Hebrew text and on the other to provide a purely Jewish version for the numerous Greek speaking Jews of the Diaspora.

In his translation Aquila became "a slave to the letter," rendering every dot and tittle, every twist and turn of the Hebrew, through some equivalent in the Greek, no matter whether it was compatible with Greek idiom or not. Moreover, he coined new Greek words and lent new meanings to existing words in order to render not only the exact meaning but also the approximate sound of the Hebrew words. Jerome dwells upon his endeavor to represent in Greek even the etymological meaning of the Hebrew words. For these and similar barbarisms and mannerisms of speech Aquila's version was eulogized by the rabbis and condemned by the Church Fathers. Yet a study of his vocabulary bears out the verdict of scholars ancient and modern that he had a fine mastery of the Greek language, and Field even compares his Greek to that of Homer and Herodotus. According to the Church Fathers, Aquila's version was in common use among Greek speaking Jews as late as the 6th century, but with the advance of the Arab conquest and the predominance of the Arabic language among the Jews of the East, it fell into desuetude and became known to students only through minor fragments preserved chiefly in the writings of the Church Fathers and collected later by editors of Origen's hexapla. In 1897 some larger fragments of continuous texts came to light through the discovery of the Genizah at Cairo. J. RE.

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**AQUILA DEGLI ABRUZZI**, a city of central Italy, the capital of the Abruzzi province, situated in the mountains in the valley of the Aterno, about 150 mi. by rail northeast of Rome. Aquila is the see of a bishop and contains two notable churches dating from the 13th and 15th centuries. The city has manufactures of linen and paper. It was founded in 1250 as a stronghold against papal authority. Pop. commune, 1931, 52,457.

**AQUINAS, SAINT THOMAS** (c. 1227-74), famous Italian theologian and scholastic philosopher, called the Angelic Doctor, a descendant of the Counts of Aquino, was born at Rocca Secca, Calabria, Italy, between 1225 and 1227. He received his first instruction from the Benedictine monks of the convent of Monte Cassino, and in early life entered the Dominican order at Naples. He continued his studies at Cologne and Paris, particularly under the guidance of the philosopher, Albertus Magnus. He was a teacher of philosophy and theology at Cologne, Paris, Bologna and elsewhere. Although in school days called "the dumb ox," he came to be known as "the greatest of the scholastics," "the father of moral philosophy," and "Doctor Angelicus." His chief book, the *Summa Theologiae*, is highly esteemed by the church, although it is an attempt to reconcile the philosophy of Aristotle with Christianity. He held that there were only two sources of knowledge: faith and reason, and believed in a physical as well as a moral goodness. To some he appears to deny the doctrine of the immaculate conception. According to Aquinas, the human soul does not exist before the body, nor does it acquire its knowledge through the recollection of ideas beheld in a previous state of existence, as Plato assumed. His followers were known as Thomists. The first complete edition of his works was issued under the auspices of Pope Leo XIII, in 1883. Pope John XXII canonized him in 1323. He died on his way to the Council of Lyons, at Fossa Nuova, near Terracina, Italy, Mar. 7, 1274.

**AQUITAINE**, a province in southwestern France, varying in extent at different times. The Aquitani submitted to Rome in 56 B.C. Aquitaine was organized as an administrative district by Augustus, and raised to the rank of a province by Tiberius. In the 5th century it became part of the Visigothic kingdom. Clovis, king of the Franks, made war on the Visigoths in 507, and seized Aquitaine. For 250 years the dukes of Aquitaine rebelled repeatedly against their Frankish overlords until finally subjugated by Charlemagne who organized the duchy into counties ruled by trusted subordinates. Aquitaine became the largest of the feudal states in France, its dukes frequently being more powerful than the Capetian monarchs at Paris. One of these dukes, William the Pious, founded the monastery at Cluny in 910. In 1137 Duke William X died, leaving as his sole heir a daughter, Eleanor. She married King Louis VII of France, bringing with her Aquitaine as a dowry. Divorced from Louis VII, Eleanor married King Henry II of England, transferring her

dowry. On her death Aquitaine passed to her heirs, the Kings of England, to become a bone of contention between England and France until the close of the HUNDRED YEARS' WAR. After the 15th century the history of Aquitaine merges with that of Guienne and Gascony.

W. I. B.

**ARA** (gen. *Arae*), the altar, a small southern constellation adjoining the tail of the Scorpion and containing a number of stars of the third magnitude. See *STAR: map*.

**ARABESQUE**, originally, any ornament in the Moorish or Mohammedan styles; now used for any complex ornament filling a panel, especially a pilaster panel. Mohammedan textiles were well known in Italy during the Gothic and Renaissance periods. A type of interlacing or intersecting ornament frequent in them was adapted for many Italian textiles; hence, the term arabesque began to be used for patterns with interlacing lines. As many pilaster panels had ornament of classic derivation whose lines crossed and recrossed, these, too, were said to be decorated with arabesques. From that use came the more modern use of the word to express any rich, complicated, or fantastic ornament.

**ARABIA**, a peninsula in the southwestern extremity of Asia between 12° and 32° N. lat. and 35° and 60° E. long., with an average breadth of 700 mi. and a length of 1,200 mi., thus having a total area of about 1,000,000 sq. mi. The Arabs usually refer to their home as the Isle of the Arabs, emphasizing thus the geographical isolation of the peninsula. With the Red Sea on the west, the Arabian Sea on the southeast, the Gulf of Oman and the Persian Gulf on the northeast, Arabia is cut off from the rest of continental Asia on the remaining side by a great desert barrier, the desert of the Northern Nefud.

The population of Arabia can only be guessed; it is possibly between 5,000,000 and 7,000,000. Of this total there are probably 2,500,000 along the Red Sea coasts, including more than 1,500,000 in Yemen; about 1,500,000 in the rest of the coastal settlements, including 500,000 in Oman; about 500,000 in the central oases, and about 1,000,000 nomads. It is these last who have influenced the history, not only of Arabia, but also of the whole world, out of all proportion to their numbers. To increase the food producing area is virtually impossible. Climatic conditions favor the growth of a virile race. With high birth and low death rates the inhabitants are faced with two possibilities, emigration or death from starvation. The surplus population usually remains for some time within the peninsula, gradually accumulating and tending to form new nomadic groups which try to establish rights to wells and pasturage already occupied. At last the action of some tribe or tribes, or sheer want, forces them out, generally to the borders of Egypt, Syria or Iraq. Hardly any part of the peninsula is unaffected by the features of life on steppe and desert. As agriculture is impossible in three-quarters of the area, even the single family must keep on the move in order to live. Yet it is

these people who have given the world the great philosophic religions of Judaism and Mohammedanism, and to some extent, Christianity.

The more numerous settled folk of the oases are of less real interest. Among the products of the fertile spots, the chief food is the date, though grain is grown in considerable quantities in the larger oases. The fine Mocha coffee is exported in small quantities, the cheaper Brazilian or Javanese variety being imported for home use. Gums, hides and wool are produced and exported in small amounts. Camel-breeding is carried on by the nomads; raising the famous Arab horses is a less important occupation. Asses are only of slightly less value than camels as means of transport.

**ARABIAN DESERT**, a vast area of barren country, consisting of tracts of steppe-desert, in northern Arabia, above 30° N. lat., which is properly the Syrian Desert or Hamad. It extends from the Palestine region on the west across Arabia to the delta of southeast Mesopotamia. Politically this waste-land is controlled by Palestine, Syria, and Iraq, but topographically the desert is part of the Arabian peninsula, and is related to the Great Nefud, or the southern desert of Rub' al Khali. On the west of this arid region is the Moab and Edom mountain system. To the east, the Arabian Desert dips gradually to Iraq. The chief oasis town is Jauf, with a population of 3,000. The nomadic Bedouins living on the desert engage in breeding camels, sheep, and goats.

**ARABIAN NIGHTS, THE** (*The Thousand and One Nights*), a collection of tales supposed to have been told by Scheherazade, wife of the Sultan of the Indies, to avert the Sultan's bloody decree that each of his brides should live but one day. The exact date of the tales is a controverted question among scholars—they belong, indeed, to all times and lands; but it is thought that they took form probably in Cairo between 1400 and 1550. They were first introduced into Europe in the French translation of Galland, published 1704-17, which aroused immediate enthusiasm. Whatever their origin and date, these stories have found a popularity such as no similar collection has ever achieved. Though thoroughly Oriental in temper and spirit, such tales as *Ali Baba*, *Sindbad the Sailor*, *The Magic Carpet*, *The City of Brass* and *Aladdin* have charmed the entire world.

**BIBLIOGRAPHY.**—Incomplete translation: *The Thousand and One Nights*, E. W. Lane, 1839-41 (since reissued many times); complete trans. by John Payne, 1882-84, and by Sir R. Burton, 1885.

**ARABIAN PHILOSOPHY**, the philosophy of the Moslems during their enlightened era between the 9th and the 12th centuries inclusive. In the East the center of learning was at Bagdad and in the West at Cordova. Scholars of both these centers had considerable influence on the Latin schoolmen of the Middle Ages. In philosophy Aristotle was the main authority, and it was through these Moslem scholars that his works became known to the West. This philosophic movement started in the East with Al-

Kindi (d. 870). Its foundations were laid by Al-Farabi (d. 950). But the greatest of the eastern scholars was Avicenna (Ibn Sina, 980-1037). His philosophy was a combination of Aristotelianism and Oriental mysticism. He believed in the doctrine of creation and the immortality of the soul. Nevertheless his teachings were not spiritual enough to suit the more orthodox Al-Ghazali (1058-1111) who aimed his *Destruction of the Philosophers* primarily against Avicenna. Al-Ghazali's attack on philosophy marks its decline in the East and the return to the Mohammedan gospel.

In the West the lesser figure was Avempace (d. 1138). In his Republic, or *Régime of the Solitary*, he outlines the rules by which it is possible to rid oneself of the sensuous world and gain possession of the intelligible one. But the outstanding figure of the West was Averroes (1126-98). He followed Avicenna's philosophy to more logical conclusions, denying both the doctrines of creation and immortality. He held that matter had always existed and saw no necessity for creation. His teachings were denounced as Averroism by the Latin scholars, but became influential.

**ARABIAN SEA**, the northwestern stretches of the Indian Ocean, bounded on the west by Africa, on the northwest by Arabia, on the north by Baluchistan and southern Persia, and on the east by India. The strait of Bab-el-Mandeb, at the eastern end of the Gulf of Aden, joins the Arabian Sea with the Red Sea and thence with the Mediterranean by way of the Suez Canal. The Gulf of Oman links it with the Persian Gulf. Other arms are the gulfs of Cutch and Cambay. The waters of the River Indus flow into the Arabian Sea. Navigation existed centuries before the era of recorded history, and coastwise trade to-day is extensive. The sea is an important part of the water route between Europe and India, and is traversed annually by considerable shipping. Except on the east, the coasts are precipitous, and the shore waters deep. The principal islands are the Laccadives and Socotra, near Somaliland. In ancient times it was known as the Mare Erythraeum.

**ARABICI**, 3rd century heretics who believed that the soul perishes with the body and, with the body, is restored to life again at the resurrection.

**ARABIC LANGUAGE**, a SEMITIC LANGUAGE belonging to the Southern group and exhibiting a closer affinity to Proto-Semitic than does any other Semitic dialect. Its alphabet, consisting of 28 consonants, preserves all the original gutturals, velars, dentals and sibilants, with the exception of *ś*.

The verb distinguishes 15 "forms," of which the last five are rarely used, the common types being 1. simple; 2. intensive; 3. reciprocal or mutual; 4. causative; 5. reflexive of 2; 6. reflexive of 3; 6. and 7. middle or reflexive of 1; 9. expressing inherent qualities or bodily defects; 10. reflexive of 5. A passive is built from each of these by internal change of vowels. Originally the verb expresses either finished or unfinished action, i.e., it denotes ASPECT rather than TENSE;

and it is only with the help of the auxiliary "to be," and with the particle *saufa* or *sa*, that Arabic, like SYRIAC, can define a more specific tense. Besides the imperative, there are four moods, indicative, subjunctive, jussive and two forms of energetic. The verb distinguishes 3 numbers, singular, plural and dual (the latter only for the second and third persons). The noun has 2 genders, masculine and feminine; 3 numbers, singular, dual, and two forms of the plural ("sound" and collective or "broken," the form of the latter being a feminine singular); three cases, nominative, genitive and accusative; and 3 states, definite, indefinite and construct. There are definite and indefinite articles.

Because of the expansion of Islam in the 7th and 8th centuries, Arabic spread over all the Near East as well as throughout northern and northeastern Africa; while through the Moorish dynasties in Spain and Sicily, it has given many words to Spanish and Sicilian. Modern Arabic dialects fall into six geographical groups, each with subdialects: Arabia, Mesopotamia, Syria, Egypt, North-West Africa and Malta.

I. M.

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**ARABIC LITERATURE** is the record of a civilization, not of a people. It is the creation of men of many different races, who, conquered, lost their national languages, customs and traditions, and grew into a unity of thought and belief with their conquerors, producing with them what is known as Moslem civilization, a spiritual force that has endured for 13 centuries and moulded the minds of men from India to Morocco, from Turkey to Zanzibar.

The character of Arabic literature, like that of other literatures, can be grasped in a measure by a consideration of the literary forms which it employs, or still better perhaps, by observing those which it does not possess. Enormously rich both in poetry and prose, it is nevertheless significant that its poetry is preponderantly lyrical, lacking the epic entirely and also the drama, and that the novel is not represented among its prose works, although in volume and quality it compares very favorably with the greatest literatures of the world in theology, philosophy and science, geography, history and philology, not to mention essays and lighter literature.

Just as significant, moreover, in this regard is the fact that Arabic literature has enjoyed an unbroken tradition of 13 centuries. For the educated of the Arabic-speaking peoples read today the poetry of the 6th century pagan Arabs, as an educated Englishman reads Spenser, or a Scot of the last generation read Fergusson and Burns. And this amazing continuity of literary tradition can be attributed on the whole to the astounding influence which two factors have exerted over the development of Arabic literature: the Koran of Mohammed and pagan Arab poetry. For they have been the basis of Moslem education and the

cornerstone of Moslem culture, much as the Bible and the classics were for former generations in the West.

**The Koran.** The Koran is the bible of the Moslem peoples, to whom it is the very Speech of God, revealed word for word to their prophet, Mohammed, through the angel Gabriel. It is written in a rhymed prose called *saj'*, and Moslems of all ages have united in maintaining its inimitability in style as well as in content. It consists of a series of revelations vouchsafed to Mohammed in Mecca and Medina between the year 610 and that of his death in 632. The earlier revelations are short and passionate utterances proclaiming the unity of God, the coming of the Last Judgment and the truth of Mohammed's prophethood; the later contain for the most part ceremonial rules and social and commercial legislation. The earlier revelations are nervous, vivid and picturesque in language; the later are dull, heavy-footed and full of wearisome repetition. The standard of literary Arabic was not set by the Koran, that was the work of the pagan poets. Nevertheless it was due to the position of the Koran as "Bible, Prayer-book, delectus and first law-book to Moslems of whatever sect" that Arabic became a world-language and the literary medium of all Moslem peoples. Moreover, to the studies connected with the Koran the most of the branches of literary Arabic owe their origin, such as philology and lexicography, tradition, jurisprudence and history.

**Pagan Poetry.** To the study of the Koran, however, the world is also indebted for the preservation even of pagan Arab poetry. For it was cherished and collected in the first place chiefly on account of its value with respect to the interpretation of the Koran, and undoubtedly some of the extraordinary authority which it has wielded over Arabic literature is due to this early association with the Moslem bible. Moslem literary critics have generally been philologists primarily, nurtured in Koranic studies, and with some brilliant exceptions they have all revered this pagan poetry as the highest achievement of human genius, and held it up as the model to be slavishly imitated, if never equaled.

And yet this pagan poetry impresses one as bare and monotonous. Rich in meters though it be, and abounding in terse and vivid phrases, its subjects are too limited for Western taste, a poetry impoverished of ideas. It mirrors too realistically the cold uniformity of the desert and the habits and ideals of its nomad society with an absence of shading and personal feeling. Its chief external characteristic, apart from its meters, is that the same rhyme runs through the whole poem, which may number 60 to 100 lines.

The chief collections of pagan poetry are the *Mu'allaqât*, made by a rhapsodist of the 8th century; the *Mufaddaliyât*, compiled by the philologist, al-Mufaddal (d. about 786), the *Diwân al-Hamâsa*, or *Poems of Bravery*, of Abû Tammâm (d. about 850), himself a poet; an anthology with the same title by al-Buhturî (d. 897), also a poet; *The Book of Songs* of Abû'l-Faraj al-Isfahânî (d. 967) and *The Book*



of *Poems and Poets* by the philologist, Ibn Qutayba (d. 885), considered by some authorities as the best anthology of Arabic poetry. The three most famous poets are the prince, Imru' ul-Qays, the leader of the poets to hell-fire in the eyes of early Moslem puritans; Zuhayr, a didactic poet; and Nâbigha. But 'Antara should be mentioned in addition, as he later became the hero of desert romances, and also Shanfarâ and Ta'abbata Sharran, two typical desert brava-doers.

**Poetry and Songs.** With the Arab conquest of half the world under the banner of Islam and the transference of the capital from Medina to Damascus under the Umayyad dynasty, 660-750, a revolutionary change took place in the scene of Arab life. From breeders of camels and caravan-traders, despised and hated by their neighbors, they became princes and generals, governors and judges, rulers of men. But Arabic poetry changed little; essentially it remained a provincial poetry. Al-Akhtal, Jarîr and Farazdaq wrote odes in the old style, but are now chiefly famous for their satires. 'Omar ibn Abi Rabi'a (d. about 720), a Meccan Don Juan, wrote love-lyrics. The Caliph Walîd II is renowned both for his profligacy and his wine-songs.

Under the Abbâsid dynasty, 750-1258, Arabic poetry became more and more artificial. The blind poet, Bashshâr b. Burd (d. 784), founded a so-called new school distinguished by the use of novel similes, which became more and more far-fetched as time went on. The great figure of the new school in the early Abbâsid period is the half-Persian, Abû Nuwâs, supreme in his wine-songs and little inferior in his love-poems, elegies and satires. His rival Abu'l-'Atâhiya (d. 826), is distinguished in that he avoided poetic conventions and mannerisms and used the simple language of the people. Unfortunately he found no imitators. In the next century al-Mutanabbî, i.e., the Would-be Prophet, developed, as Brockelmann says, the seeds present in the form of the ode to their full ripeness, indeed to over-ripeness, for everything in Mutanabbî is driven to immoderation.

There remains the unexpected figure of Abu'l-'Alâ al-Ma'arrî (d. 1057), writer of Spanish-Arabic mystical poetry. Abu'l-'Alâ's early poems are the usual artificial productions of his age, but in his *al-Lûzumîyât* he shows himself to be not only a great poet, but also a great humanist and a deep, if pessimistic thinker. Spanish-Arabic poetry is interesting because it possesses strophic forms, such as the *muwashshah* and the *zajal*, and because the *zajal* certainly contributed, if it did not actually originate, the *dolce stil nuovo* of Romance poetry. The two best-known Spanish poets are Ibn Zaydûn of Cordova (d. 1071), the greatest of them all, and al-Mu'tamid (d. 1095), the last native ruler of Seville.

Arabic mystical poetry generally describes the mystical state of union with God in terms of intoxication and love, and there is no end to it. The three great masters are al-Hallâj of Bagdad (d. 921), 'Omar b. al-Fârid (d. 1235) and Ibn 'Arabî of Murcia (d. 1240).

**Tradition** is a peculiarly Moslem science, and the story of its development is a curious one. Whenever religious or ceremonial, social or legal problems arose within the expanding Moslem community, Moslem scholars used to imagine what the practice of the Prophet would have been in the given circumstances and then pass their judgments into circulation as a tradition proceeding from the Prophet himself. These judgments were often in open contradiction, and thus the students of Tradition were forced to find some means of discriminating between them. They pitched upon the authenticity of the chain of authorities by which the Tradition was supported, but a chain of authorities could be forged as easily as a tradition, and so finally the Traditionists came to an agreement that only certain chains of warrantors should be regarded as authoritative. The two chief collections of Tradition are the *Sahîh*, or Sincere Book, of Bukhârî (d. 870) and the *Sahîh* of Muslim (d. 875), which have become canonical books in Islam. Even the Shî'ite sect accepts them, although it has its own collections.

**History.** The philological studies in connection with the Koran entailed researches into the history of pre-Islamic Arabia. The Traditions included of necessity the Prophet's military expeditions. And thus began Arabic history. Al-Wâqidî (d. 823) composed a monograph on the Prophet's military expeditions (Maghâzî), and Ibn Ishâq (d. 766) wrote a biography of the Prophet, which has come down in a revised edition made by Ibn Hishâm (d. 834), and is the standard authority for the history of Mohammed's life.

Arabic literature includes universal histories like the *History of the Caliphs* by Tabarî (d. 923), *A History of the Conquests* by al-Balâdhurî (d. 893), the *Kâmil* of Ibn al-Athîr (d. 1234), *The History of the Caliphs* of al-Suyûtî (d. 1505), and the greatest of all, *The Book of Examples* of Ibn Khaldûn, the first philosophical historian. The most celebrated monographs are two biographies of Saladin by contemporaries, 'Imâd ad-Dîn of Isfahân (d. 1201) and Bahâ ad-Dîn of Mosul, Saladin's chief secretary, the biography of Tamerlane, *The Marvels of Destiny*, by Ibn 'Arabshâh (d. 1450) and *History of Spain*, by al-Maqqarî (d. 1632). Biography is also represented by such general works as a *Dictionary of Men of Letters*, by Yâqût (d. 1229) and *Obituaries of Eminent Men*, by Ibn Khallikân (d. 1282), and political philosophy by *Principles of Government*, by al-Mâwardî (d. 1058).

**Philosophy.** Arabic philosophy is a development chiefly of Aristotelianism as interpreted by its Neoplatonic commentators, and it is important because of the influence which it had on the later Latin schoolmen of western Europe. Three Moslem thinkers stand head and shoulders above their fellows, al-Fârâbî (d. 950), Ibn Sînâ (d. 1037) and Ibn Rushd (d. 1198).

The primary importance of al-Fârâbî was as a teacher of logic. He was the author of a series of

commentaries on Aristotle's logical *Organon*, and wrote besides an *Introduction to Logic* and an *Abridgment of Logic*. Perhaps, however, his most interesting work is a Moslem version of Plato's *Republic* conceived as both Church and State in one.

Ibn Sînâ, or Avicenna, has long been known in Europe as representing the climax of Moslem science, but it is often forgotten that he was first and foremost a philosopher with 68 philosophical works to his credit. His *Book of the Healing* (i.e., of the soul) is an encyclopedia of logic, physics, mathematics and theology. His *Canon* is a voluminous medical encyclopedia, which governed European medical thought for several centuries after its translation by Gerard of Sablonita in the 13th century. He also wrote a charming, short, mystical poem, *The Descent of the Soul into the Body*.

Ibn Rushd, or Averroes, was the great and final Moslem commentator of Aristotle, and it was in this aspect that he became best known to subsequent generations among the Jews and the later Latin school-men, for whom he was the expounder of Aristotle's ideas.

**Theology.** Moslem theology had a forced growth. In the beginning Moslem faith was naive and simple, like all faiths. It was enough to believe in the One God and His Prophet and to accomplish the prescribed duties and rites. But at the very outset this simple faith was confronted with the developed doctrines of Christianity and Judaism, and Moslem religious thought developed along the same lines and based itself upon the same philosophical principles as Jewish and Christian thought.

The greatest name in theology is that of al-Ghazâlî (d. 1111), to whom is due the final triumph of Ash'arite doctrine with its principle that only revelation, and not philosophical theory, can form the basis of religious thought. Dissatisfied with scholastic theology and philosophy, Ghazâlî turned to mysticism and modified the Ash'arite system by leavening it with many mystical ideas. His greatest work is *The Revivification of the Religious Sciences*, which title speaks for itself. His *Disintegration of the Philosophers*, opposing the exclusive use of reason in theology, should also be mentioned. His *Rescuer from Error* is a sort of *Apologia pro Vita Sua* wherein he illustrates his faith from his own experience.

It has been remarked that Ghazâlî introduced mystical ideas into Moslem theology. The mystics of Islam are named Sûfis, and a huge mystical literature exists both in poetry and prose. There are lives of the saints describing their ascetic practices, the marvels they have performed, and the ecstasies they have enjoyed. There are systematic expositions of the principles and practices of the Sûfis, and there are mystical philosophies. The chief poets have already been mentioned. The most celebrated prose works are the *Risâla*, or Treatise, by al-Qushairî (d. 1072), *Lives of Pious Men*, by al-Mausilî (d. 1137), *The Philosophy of Illumination*, by Yahyâ al-Suhrawardî (d. 1191), and *Meccan Revelations* and *The Apparition of the Sacred Mysteries*, by Ibn 'Arabî.

**Polite Learning.** Finally there is a large class of literature in Arabic labelled *Adab* or Polite Learning, corresponding roughly to belles-lettres, written for a broader public and containing anthologies, compendiums of knowledge, letters, sermons and essays on all sorts of subjects, with which one may group such works as the *Arabian Nights* and those known by the name of *Maqâmât*, or "Assemblies." As examples of the *Adab* literature one may cite the *Fountains of Story* and the *Book of Subjects of Knowledge*, both by Ibn Qutayba (d. 885), the *Letters* of al-Khwârizmî (d. 1002) and *The Unique Necklace* of Ibn 'Abd Rabbihi (d. 940).

The "Assemblies" were the invention of al-Hamadhânî (d. 1008), called "The Wonder of the Age," and are in fact the old-time tales in alternate prose and verse decked out with the literary graces of rhymed prose and the fascination of impromptu composition; but by a stroke of genius Hamadhânî chose as the mouthpiece of his wit and fancy that beloved figure of popular story, the witty vagabond.

Hamadhânî has had many imitators, but he has been surpassed by one only, al-Harîrî of Basra (d. 1122), whose "Assemblies" are prized for their literary and linguistic qualities till this day and are "esteemed as, next to the Koran, the chief treasure of the Arabic tongue," containing infinite allusions to every branch of learning and all sides of life and endless *tour de force*, a very miracle of literary invention.

**Stories and Romances.** Over against this pedantic type of literature stands a group of story-cycles and romances, popular literature touched up by literati. The best known is the *Arabian Nights*, the history of whose composition is still obscure. The frame-story of Shahrâzâd and Dînârzâd has been traced to India, but the tales enclosed within this frame seem to have been often changed. Different story-tellers made up the sum of the 1,001 nights with different tales, as the place and time of the story changed. Folk-lore elements from the most diverse countries are included. Even the language varies greatly. Other popular stories are the *Romance of Antâr*, a tale of chivalry, and the *Romance of the Beni-Hilâl*, a story of the invasion of North Africa.

At the end of the 19th century a literary movement began in Syria and spread to Egypt, which has been hailed as a renaissance of Arabic literature. Nothing enduring has yet appeared, and it is too early to pass judgment on the success or failure of the movement. The leaders of it are well aware that they are but the precursors of the dawn which they hope will break on their beloved lands. But if a glorious past be any guarantee of a bright future, their hopes may be fulfilled.

W. TH.

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**ARABS**, members of the Arabic division of the Semitic race. Originally their home was in Arabia; but since the rise of MOHAMMEDANISM they have spread into Europe, Asia and Africa and are found in a portion of Mesopotamia, on the shores of the Red Sea, the east coast of the Persian Gulf and in large sections of Northern Africa. Traces of the Arab type were met with in Asia Minor, the Caucasus, western Persia and southern Asia. In northern Africa the term Arab designates any follower of Islam regardless of admixture of Negroid or other foreign blood.

Arabs and their followers entered Europe from northern Africa in the 8th century in the Moorish invasions and have left definite traces of racial and cultural influence in southern Spain. The Arabs are characteristically nomadic herdsmen dwelling in tents. They are good stock-breeders and are famous for their pure blooded horses, but are reluctant and exceedingly poor agriculturists. They are a courageous and warlike people, whose social organization is theocratic and feudal. Individual communities are ruled by a despotic sheik. As fanatical followers of the prophets, marabouts and mahdis who proclaim the will of Allah, they have succeeded during the centuries since Mohammed in spreading the doctrines of Islam over much of the Mediterranean area and southern Asia. The pure Arab type, characterized by a sun-bronzed skin, elongated face, aquiline nose and slim graceful body is found in southern Arabia among the Ariba Arabs, the mountaineers of Hadramaut and Yemen and among the Bedouins who are the descendants of the Ishmaelites of the interior of central and northern Arabia.

**ARACAJU**, a city of Brazil and capital of the state of Sergipe, situated about 6 mi. from the coast. The River Cotinguiba empties into the sea at this point and forms the harbor, which is too shallow for large vessels. It has the usual government buildings and an agricultural school. Extensive limestone quarries are found near by and the main products of the district are sugar and cotton, which are exported. The city was founded in 1855. Pop. 1920, 37,400; est. pop. 1930, 49,114.

**ARACHNE**, a Lydian maiden so skillful at her loom that she challenged ATHENA, or the Roman MINERVA, to compete with her. Arachne wove a tapestry showing the amours of the gods, which was so perfect that Athena, in a rage, tore it up. Arachne attempted to hang herself, but Athena loosened the rope and so saved the girl's life. The rope, however, was changed into a cobweb and Arachne became a spider, the creature of all others most odious to Athena. *Arachnida* is the generic term for scorpions, spiders and the like.

**ARACHNIDA.** See SPIDER.

**ARAD**, capital of the Rumanian district of the same name, situated on the Maros River at the edge of the Hungarian lowland. Arad has developed from a country town to a center of trade and industry. Planted with trees and flowers and lined by imposing

buildings, Arad has become one of the finest cities in Rumania. Important commercially, Arad has many factories and mills; and, as a cultural center, the capital is the seat of an Orthodox bishop with a theological seminary, many normal schools and libraries. During the Hungarian War of Independence, Kossuth held his government here. Of the inhabitants 40% are Hungarians, 20% Rumanians and 10% Jews. Pop. 1930, 77,225.

**ARAGO, DOMINIQUE FRANÇOIS** (1786-1853), French physicist, was born at Estagel, Perpignan, Feb. 26, 1786. His most important researches were in the fields of optics and magnetism. He exposed the relation between the aurora borealis and variations of magnetic elements. He contributed with Malus and Young to the formation of the undulatory theory of light, and pronounced certain fundamental laws relating to the polarization of light. Arago devised a polariscope, and after 1838 undertook studies of the speed of light in various media. He died at Paris, Oct. 2, 1853.

**ARAGON**, a former kingdom in northeastern Spain, embracing the modern provinces of Huesca, Teruel and Zaragoza, an area of 18,294 square miles. The district formed a part of the Roman province of Hispania Tarraconensis, falling in the 5th century to the Visigoths and in 711 to the Moors. A group of Christians fled to the northern fastnesses between the Sierra de la Pena and the Pyrenees, and established a rule independent of the Moors. For three centuries the refugee state was controlled by Gothic counts. In 1035 Aragon achieved complete autonomy under the leadership of Ramiro I, and for 450 years thereafter the region was one of the small kingdoms of Europe. Throughout this period of its history the subjects were in constant conflict with the Moors, and gradually wrested control of towns and fortresses in the northeast peninsula. By 1340 the King of Aragon had extended his authority to the Balearic islands, Sardinia, Sicily and Naples. In 1479 the kingdom was united by a personal union with CASTILE, and in 1516 Aragon was merged in united Spain.

**ARAGONITE**, calcium carbonate of a different form of crystallization than the usual variety, CALCITE. Aragonite crystallizes in the ORTHORHOMBIC SYSTEM, calcite in the rhombohedral division of the HEXAGONAL SYSTEM. In color it is usually white but is sometimes yellow, gray, green or violet. It is found in beds of gypsum, shale, iron ore, in basalt and occasionally in lavas and in ore deposits. Aragonite has been observed in the process of formation by deposition from solution in mine workings, as at Eureka, Nev., and in the winter from hot springs at Baden, Germany. A common occurrence of aragonite is as the pearly layer on the inner surfaces of such shells as the clam, some oysters, the pearly nautilus, and as the pearl. It is also found in the form of stalactites, stalagmites, in scaly masses, in coral-like aggregates and fibrous masses. Aragonite is named after Aragon, in Spain, where it was first discovered.

**ARALIA**, the name given to a large group of aromatic herbs, shrubs and small trees of the ginseng family, found widely throughout the world. They are often spiny with foliage much divided into toothed leaflets, and bear showy clusters (umbels) of small white flowers. Many are grown as ornamentals and some are of medicinal value. The Hercules' club (*A. spinosa*), the spikenard (*A. racemosa*) and the wild sarsaparilla (*A. nudicaulis*), are among the species that occur in the United States. See also ANGELICA-TREE.

**ARAL SEA**, a sea or lake in Asia, separated from the Caspian Sea by the Ust Urt plateau, and with a present area of about 24,000 sq. mi. The largest lake in the steppes of Asia, Aral was formerly far more extensive; the watermarks on the Chink and many other indications show that its level was at least 250 ft. higher than at present; yet it still stands about 120 ft. above the Caspian. It is fed by the Jaxartes and Oxus and has no outlet. But for these influents the lake would disappear in a few years. The area now occupied by Aral has been dry land twice within historic times, the Jaxartes and the Oxus once running south of the Aral to the Caspian; this may be the reason that neither the Greeks nor MARCO POLO made any mention of the lake. In recent years a slow process of desiccation has been steadily going on, by which its size has in a short time been reduced about 2,000 sq. mi. Although the water is brackish, fish, including carp, sturgeon and herring are abundant. Navigation is difficult owing to multitudes of small islands.

**ARAMAIC**, a North-Semitic (see SEMITIC LANGUAGE) dialect employed for purposes of writing and commerce by Semitic Aramaeans, who appeared in northwestern Mesopotamia in the 14th century B.C., as well as by non-Aramaeans, and even by non-Semites in Asia Minor. It superseded ACCADIAN and, during the period of Persian supremacy, became the official language throughout western Asia and Egypt. Its characteristics, as compared with the CANAANITE group, are substitution of dentals for sibilants, coalescence of gutturals, use of the absolute, construct and emphatic states, plural inflexion in *n*, and suffixing of the definite article. The Aramaic dialects are divided into two groups: 1. Western Aramaic, which includes a. inscriptions and papyri found in Babylonia, Assyria, Arabia and Egypt; b. Palestinian Aramaic (the Aramaic of the Old and New Testaments, Targumim and Jerusalem Talmud); c. NABATAEAN; d. PALMYRENE; e. SAMARITAN; and g. the modern dialect of Ma'lula; and 2. Eastern Aramaic, comprising a. the language of the Babylonian Talmud (Gemara); b. MANDAean; c. SYRIAC; and d. the modern dialects of Urmia, Mesopotamia, Mosul and Kurdistan. I. M.

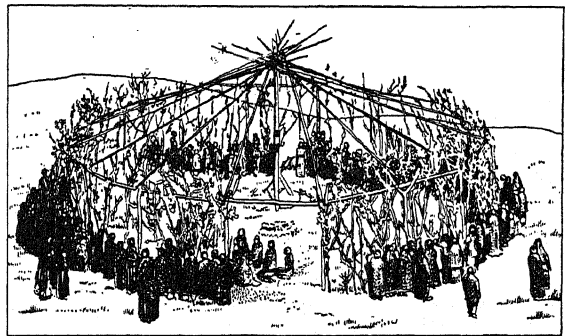
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**ARAN ISLANDS**, a group of three islands off the west coast of the Irish Free State at the entrance of Galway Bay. In order of their size, they are Inishmore, Inishmaan and Inisheer. On their seaward side they are faced with sheer limestone cliffs, where multitudes of sea fowl gather. Pop. 1931, 1,625.

**ARANJUEZ**, a city of central Spain in the province of Madrid. It is about 30 mi. south of Madrid on the Tagus River. The fine castle, once the spring residence of the Spanish court, begun under Philip II, has paintings and art treasures and is surrounded by large gardens decorated with marble fountains, extensive parks and woods of splendid deciduous trees. The town provides Madrid with vegetables and strawberries. Est. pop. 1929, 13,000.

**ARANY, JANOS** (1817-82), Hungarian poet, was born at Nagy-Szalonta, Mar. 1, 1817. His satirical poem, *The Lost Constitution*, and his epic trilogy, *Toldi*, raised him, provincial notary, from obscurity to a position in Hungarian literature second only to that of SANDOR PETÖFI. Making use of Magyar folklore in his ballads, Arany first directed Hungarian literature into national channels. The poet died at Pest, Oct. 24, 1882.

**ARAPAHO**, one of the typical Plains tribes belonging linguistically to the great western division of the Algonkian stock. Before the period of white contact they appear to have migrated southwest across the Missouri River from the region of the Red River valley of northern Minnesota where, according to their traditions, they lived a sedentary agricultural life, in contrast to their roving nomadic existence in historic



FROM A MODEL IN AMER. MUS. OF NATL. HISTORY

SUN DANCE OF THE ARAPAHO INDIANS

times. Culturally they were typically Plains, depending largely on the buffalo and its products for food and clothing, living in tipis, possessing age-graded military societies, and performing the sun dance in its most complete form.

There are two major groups of the Arapaho, each subdivided into local bands. The Southern Arapaho have since about 1867 occupied a reservation in Oklahoma jointly with the Southern Cheyenne, while the Northern Arapaho have, since 1876, been on the Wind River Reservation in Wyoming. About a third of the estimated former population of between 3,000 and 4,000 survive.

**ARAPAIMA**, a large, tropical, fresh-water fish (*Arapaima gigas*) of the family *Osteoglossidae*, found in Brazil and the Guianas. It is the largest fresh-water fish, often exceeding 15 ft. in length and weighing around 400 lbs. The arapaima is distinguished by its deeply-cleft mouth with the prominent lower jaw, and by its rounded body, covered with bony scales of mosaic structure. The flesh of the arapaima is highly valued as food.

**ARARAT, MOUNT**, the name given to the high peak of the Armenian plateau. Ararat really constitutes the eastern and culminating point of the volcanic range which forms the water-parting between the Aras and Murad-chai, or eastern branch of the Euphrates. Its seemingly isolated position and imposing appearance have from the remotest times encircled it with legends and traditions. A number of places in the vicinity still betray in their very names the traces of the Noachian tradition, and are held in great veneration both by Armenians and Tatars. Although Biblical traditions survived, the Biblical name of the mountain was forgotten in the neighborhood. The Armenians know it only as the Masis Lern, i.e., the Grand or Sublime Mountain.

Viewed from Nakhichevan, Ararat presents the appearance of a single cone bounding the horizon towards the northwest; but it really consists of two separate cones known as Great and Little Ararat, resting on a common base and separated by a deep intervening depression 7 mi. wide. The higher cone consists itself of a double peak, and the whole mass, with its projecting spurs, covers over 370 sq. mi. between Erivan and Bayazid. Owing to the slight moisture there are no large forest trees in Ararat which, however, is clothed with vegetation to a height of over 11,000 ft. Pasturage extends thence to nearly 13,000 ft., beyond which an alpine flora struggles up to 14,200 ft., which marks the snow line. The chief elevations are Great Ararat, 16,916 ft.; Little Ararat, 12,840; the connecting ridge, 8,780 ft.

**ARAUCANIAN**, a linguistic stock of South American Indians made up of various tribes living chiefly in the pampas region of northern Chile. When the Spaniards made their first appearance in 1535, they found the Araucanians a strong and virile people of comparatively advanced civilization who engaged in agriculture and llama breeding and were ruled over by a hereditary aristocracy. Though they had never been under Inca domination, their culture showed strong Peruvian influence. Almost continuous warfare was waged between the Spaniards and the Araucanians from 1550 until 1882 when the Indians, after more than three centuries of resistance, were finally forced to submit to Chilean rule. This long period of hostilities greatly changed Araucanian civilization. The true Araucanians who still survive live chiefly in the province of Arauco. They are a peaceful, Christian people and are excellent horsemen and cattle-breeders. A large number have trekked eastward over the Cordilleras, gradually intermingled with the pampas tribes, and have become nomadic hunters. This

Indian stock has also intermarried extensively with the whites.

**ARAUCARIA**, a genus of lofty evergreen trees of the pine family native to the Southern Hemisphere. There are about 15 species found in South America, Australia and the Pacific Islands, most of which are highly valued for timber, yield abundant resins and produce edible seeds utilized by the native peoples for food. Several are grown as ornamentals in the open in mild or subtropical regions, as southern Florida and California, and in their young stages as pot or tub plants in the North. The araucarias have very tall erect trunks, sometimes exceeding 200 ft. in height, with regularly whorled branches bearing stiff, flattened, sharp-pointed, mostly imbricated leaves and huge woody cones, sometimes 8 in. in diameter, containing numerous large seeds.

Among the most valuable species are the Chile pine or monkey-puzzle tree (*A. araucana*) and the Brazilian pine (*A. brasiliensis*), of South America; the Norfolk Island pine (*A. excelsa*), of Norfolk Island and New Caledonia, a magnificent tree 150 to 220 ft. high, and the Moreton Bay pine (*A. Cunninghamii*) and the bunya-bunya pine (*A. Bidwillii*), of Australia.

**ARAWAK**, the most widely distributed linguistic stock of the tropical forest area of South America. Originally the tribes of this stock inhabited, with interruptions, territory extending from southern Brazil and Bolivia north to the coast between the mouth of the Orinoco and the delta of the Amazon, including several tribes in Peru, Ecuador and Colombia. Until the invasion of the CARIB tribe in the latter part of the 15th century they also inhabited both the Lesser and Greater Antilles. Columbus landed in Arawakan territory, in the Greater Antilles, and from Taino, the Arawakan language of the Antilles, many words found their way directly into European vocabularies. The most common of these are *tabako* (tobacco), *hamaka* (hammock), *kanua* (canoe), *mahiz* (maize).

Both men and women wear but the most rudimentary covering despite their comparatively advanced civilization. Tillage, in the form of forest-clearing, is the basis of their economic life. *Mandioca brava* (*Manihot utilisima*) is the chief crop. Maize, sweet potatoes, beans, tobacco and to some extent cotton are also grown. Cattle-raising is entirely unknown. Animal food is supplied by fishing with bow and arrow, spear and trap and by hunting. The majority of these tribes are exceptionally clever at pottery-making and wickerwork which they decorate in geometric designs of certain artistic merit.

The village community is the most important economic unit and is usually ruled over by a village head, sometimes more than one. Several villages frequently combine under a common chief and the Paressi Indians are said at one time to have been organized as a single large state. The most important existing tribes are the Anti, Arawak, Barre Goajiro, Guano, Manaos, Maneteneri, Maipuri, Marauho, Moxo, Passé, Piro, Taruma and Wapishana.

**ARBELA, BATTLE OF**, 331 B.C. Fought on a great plain in Assyria, between Arbela and Gaugamela, it is sometimes called by the latter name. Two years earlier, at Issus, ALEXANDER THE GREAT had defeated DARIUS III who attributed the overwhelming disaster to the rather cramped position of the Persian troops. Here, on this flat expanse, he would restore his fortunes. But Issus was repeated. Darius fled, in the royal chariot, and the main body of the army followed. This victory assured to Alexander the mastery of Persia.

**ARBITRAGE**, the purchase and sale of the same thing in different markets, in order to profit by the variations between the prices ruling in the markets traded in. The operation may be conducted in FOREIGN EXCHANGE, in STOCKS and BONDS or in commodities. As an exchange operation, it may involve the conversion of a fund in the currency of one country into the currency of another country, and at times, further conversion into the currency of a third, or even fourth country,—prior to ultimate re-conversion of the fund into the initial currency, with the accretions made possible by the relative positions of the exchanges dealt in.

As a security or commodity operation, it may involve the purchase in one market and the sale in another, of the thing dealt in, at a difference which nets a profit, though the currencies utilized in payment and received in sale are at parity, and arbitrage in exchange consequently without profit. The object of arbitrage is a predetermined profit, not speculation, and consequently the operations must be as simultaneous as possible. W. W.

**ARBITRATION, INTERNATIONAL**, a pacific means of settling disputes between national states by judges of their own choice. During the 19th century arbitration was increasingly resorted to, although states were not disposed to employ it in cases involving "national honor" and "vital interests." Its use was promoted by the establishment of the Permanent Court of Arbitration at the First HAGUE CONFERENCE in 1899.

**ARBITRATION AND CONCILIATION**, terms applied to certain methods for preventing labor disputes. Conciliation in its strictest usage refers to settlement of disputes by direct conferences of the parties involved or their representatives, without outside assistance. The joint council created by some TRADE AGREEMENTS illustrates this method. It brings together the parties regularly to discuss matters of common interest and to settle possible disputes. When an outside body or person intervenes to bring together the disputants for the purpose of settling their differences amicably, the procedure is better termed "mediation," although it is also called conciliation, the terms being used interchangeably in the United States. It is the office of mediator or conciliator to act as confidential adviser to both parties and to suggest a mutually acceptable basis for adjustment. The procedure is diplomatic rather than judicial. It may bring peace without a just or thorough settlement.

It often deals with the psychological difficulties inherent in a situation, without meeting the basic economic problem involved.

Intervention by a third party may be voluntary, e.g., a private individual or government officials may offer their services; or the agreement may set up machinery either making it obligatory at the request of either party to the dispute, or at the summons of the conciliator, leaving the parties to decide whether or not they will have recourse to it. The proposals of the conciliator may or may not be accepted; there are no penalties provided in event of noncompliance. In case the parties fail to reach an amicable settlement, by themselves or with the assistance of a mediator or conciliator, recourse may be had to investigation, i.e., discovery and publication of material facts in the dispute, or finally, to arbitration.

The essential nature of arbitration is the determination of questions at issue by some outside authority, usually with some measure of compulsion, direct or indirect, available to enforce the finding. It thus differs fundamentally from conciliation, the essence of which is voluntary agreement. Arbitration may be voluntary or compulsory. Voluntary arbitration is often provided for in the trade agreement. Both parties agree to submit the question at issue to an impartial umpire or board. Agreement to arbitrate usually provides for arbitration procedure, involves investigation of pertinent facts and conditions underlying the dispute and for cessation of STRIKES or LOCK-OUTS pending decision. Acceptance of the award is voluntary and not enforceable by definite penalties.

In compulsory arbitration the government directly or indirectly compels the disputants to submit their differences to an outside authority for adjudication and award. The disputants may or may not be compelled to accept the arbitration decision. In the former case the procedure is known as compulsory arbitration with compulsory award, in the latter, as compulsory arbitration with voluntary award. Usually the award is voluntary, public opinion being relied upon to enforce it.

Arbitration and conciliation are frequently combined, the arbitrator endeavoring as far as possible to pursue the rôle of conciliator and falling back on arbitration only as a last resort. M. G.

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**ARBOR DAY**, the day designated for the annual planting of trees by various states and territories of the United States. The date varies in different states, but in the North it usually falls in April or May and in the South in December, January or February. In about one-third of the states of the Union, Arbor Day is a legal holiday; in the rest it is a school holiday. The purpose of the observance is to emphasize the importance of forest conservation and reclamation; and with this aim in view, the cooperation of school children is especially sought. The observance originated in Nebraska in 1872, and in 1885 Arbor Day



was appointed a legal holiday in that state. J. Sterling Morton was responsible for the proposal to set apart one day each year for the planting of trees and to name this day Arbor Day; but as early as 1865, B. G. Northrop, then secretary of the Connecticut board of education, suggested that the state government should undertake a scheme whereby attention would be called once a year to the importance of planting trees.

**ARBORETUM**, a collection of growing trees and shrubs usually gathered for study or ornament or both. Such collections are often connected with some learned institution and result in valuable researches upon classification, hardiness, the exploration and discovery of new species, and, sometimes, experimental work in forestry. One of the most noted is the Arnold Arboretum of Harvard University, which maintains thousands of shrubs and trees, together with a large herbarium and an excellent botanical library.

**ARBOR VITÆ**, a name given to a genus (*Thuja*) of resinous evergreen trees of the pine family comprising many handsome ornamentals. There are six species, two of which are native to North America and the others to eastern Asia. Four of these, together with numerous horticultural varieties and races, are extensively planted for their highly decorative foliage and formal habit. In their native forests they are trees of narrow pyramidal form with short, much ramified branches, flattened branchlets arranged like leaves, minute, scalelike true leaves and small erect cones. Many garden varieties are low and bushy, often having pendulous branches and variegated foliage.

The American arbor vitæ (*T. occidentalis*), sometimes called northern white cedar, is found chiefly in swamps and on stream banks from Nova Scotia to Saskatchewan southward to Virginia and Minnesota. It grows 50 to 60 ft. high with a trunk 2 to 3 ft. in diameter. The soft, coarse-grained wood, very durable in water, is used for fence posts, railway ties and shingles. More than 50 forms produced by nursery cultivation are grown for ornament, especially for hedges.

The giant arbor vitæ (*T. plicata*), a handsome tree sometimes 200 ft. high with a huge buttressed trunk occasionally 15 ft. in diameter at the ground, grows from northern California eastward to Montana and northwestward in the mountains to Alaska. It bears cinnamon-red bark and very numerous slender branches, usually pendulous at the ends. The reddish-brown wood, extensively lumbered in Washington and Oregon, is used for interior finish, cabinet work, cooperage and many other purposes. Many columnar and pendulous forms are grown as park ornamentals in mild climates, especially in western Europe.

Of the Old World species the best known is the Chinese arbor vitæ (*T. orientalis*), widely planted in numerous varieties. It differs from the American species in having the flattened leaflike branchlets ar-

ranged in vertical instead of horizontal planes. See also EVERGREEN.

**ARBUTHNOT, JOHN** (1667-1735), noted British physician and wit, was born at Arbuthnot, Kincardineshire. For a time he was instructor of mathematics in London and was able to enter Oxford in 1692. He received his degree of M.D. from St. Andrews in 1696. He supported himself for several years partly by contributions to the literature of mathematics, but he chanced to be called in an illness of Prince George of Denmark and thereafter became fashionable as a physician. He was friend and counsellor of Swift and Pope, and is better known for his witty contributions than for his medical works. His *History of John Bull* popularized that title as a name for the Englishman. Arbuthnot was a friend and adviser to Lord Chesterfield, Thomas Gay, and William Congreve, and was for a brief period royal physician in ordinary to Queen Anne. The prologue to the satires of Pope is entitled *Epistle to Dr. Arbuthnot*. He died in London, Feb. 27, 1735. M. F.

**ARBUTUS**, the name of a group of handsome woody plants of the heath family with evergreen foliage grown as ornamentals in warm-temperate regions. They are characterized by their smooth red bark which peels off in large thin plates. The attractive flowers form in terminal clusters and, ranging in color from red to white, are followed by a red, berry-like fruit. See also MADRONA.

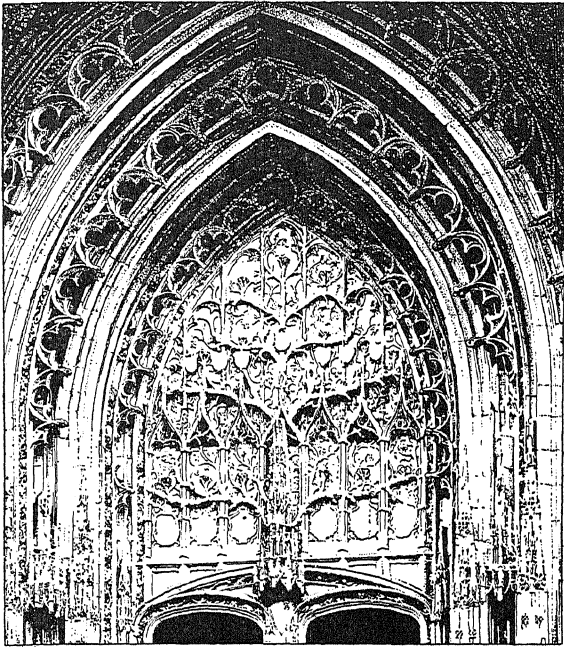
**ARBUTUS, TRAILING** (*Epigæa repens*), called also MAYFLOWER or ground laurel, a low, creeping, slightly woody plant of the heath family, found on hillsides and in rocky woods widely throughout eastern North America. The small clusters of delicately fragrant pink or whitish flowers appear amongst the discolored leaves of the preceding season. New bright green leaves develop in the early summer. Blooming early in April or even in March, while the snow is still on the ground, it is greeted as one of the first signs of spring. The trailing arbutus is the state flower of Massachusetts.

**ARCADIA**, "The Countess of Pembroke's Arcadia," prose romance in five books by SIR PHILIP SIDNEY, written about 1580 and published in 1590. This elaborate tale of the adventures of two shipwrecked princes who woo the daughter of the King of Arcadia, thereby causing a certain oracle to be fulfilled, owes much to the pastoral romances of Sanazzaro and Montemayor.

**ARCADIA**, a city in Los Angeles Co., southern California, 15 mi. northeast of Los Angeles. It is served by bus lines and the Santa Fe and the Southern railroads. The chief crops produced in the vicinity are vegetables and flowers raised for the wholesale market. Arcadia has a textile mill and several other small factories. Angeles National Forest lies to the north of the city. Arcadia was founded and incorporated in 1903. Pop. 1920, 2,239; 1930, 5,216.

**ARCAGNUOLO**. See ORCAGNA.

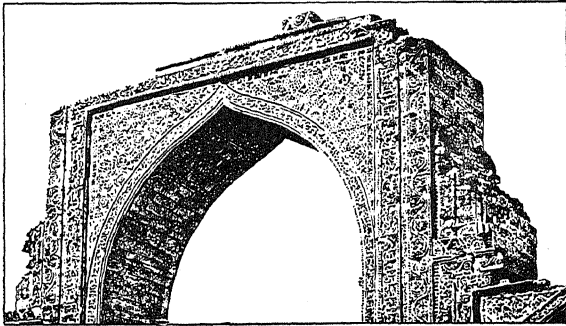
**ARC CUTTING AND WELDING**. See METAL CUTTING BY HEAT; WELDING.



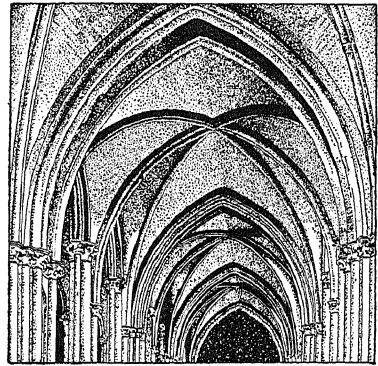
POINTED ARCH OF THE NORTH TRANSEPT, CATHEDRAL OF ST. PIERRE, BEAUVAIS, FRANCE



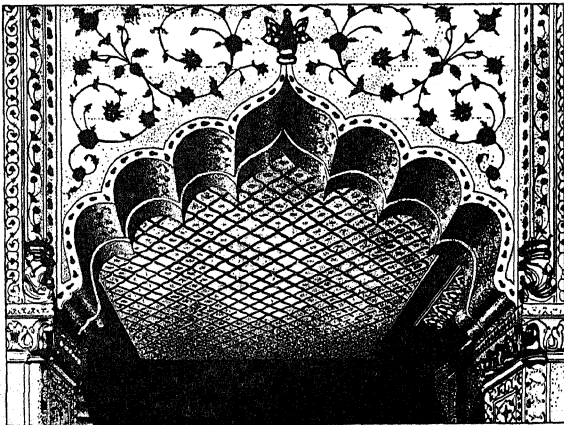
ARCH AT ENTRANCE TO THE CHOIR, CHURCH OF SANTA MARIA DEGLI ANGELI, ROME



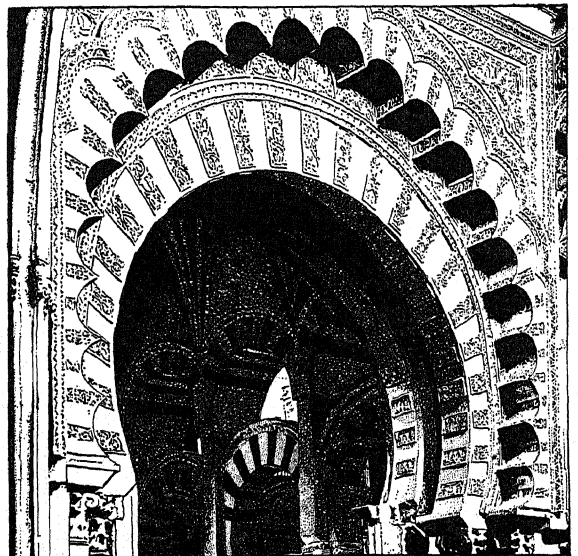
GREAT ARCH AT DELHI, INDIA  
*Example of the Oriental ogee arch*



GOTHIC ARCH, CATHEDRAL OF ST. JOHN THE DIVINE, NEW YORK



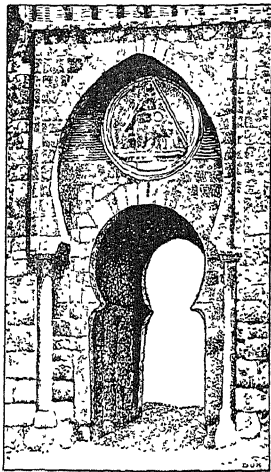
ENGRAILED ARCH, IN THE DIWAN-I-KHAS, OR HALL OF PRIVATE AUDIENCE, PALACE OF DELHI, INDIA



CUSPED AND PLAIN HORSESHOE ARCH, CORDOBA CATHEDRAL, SPAIN

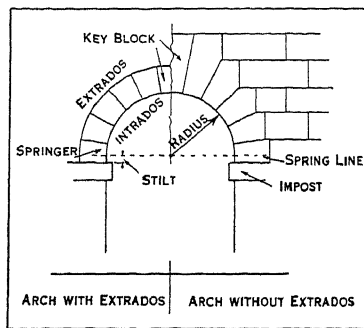
**ARCH**, strictly, a combination of wedge shaped pieces arranged together so as to bridge an opening wider than any of its single units. Owing to its mechanical properties and physical laws, an arch exerts not only weight upon its supports, but also thrust, that is, a pressure outwards. To keep the arch stable, this thrust must be restrained by suitable abutments or **BUTTRESSES**. This fact governed the development of many architectural forms especially in Roman, Romanesque and Gothic times.

The simplest arches consist merely of two stones over an opening with their apexes leaning together like an inverted V. The more highly developed types with a semicircular *intrados*, or underside, are found as early as the third millennium B.C. in Mesopotamia, and there are various early Egyptian examples. The Assyrians developed a decorative treatment for arches in Palace and City Gates, using glazed tile as a band around the curve. In the stone arches of Etruria and Rome the decorative possibilities were fully realized and highly developed. Arch design also played an important part in Romanesque, Gothic and Mohammedan architecture.



HORSESHOE ARCH  
OF THE PUERTO DEL SOL,  
TOLEDO, SPAIN

Arches may be flat, segmental, round or of almost any shape provided that the wedge shaped individual pieces have joints continuously radiating. In any arch, the under surface is known as the *intrados*, the upper or outer surface as the *extrados*, and the individual wedge shaped pieces as *voussoirs*. The central or highest voussoir is

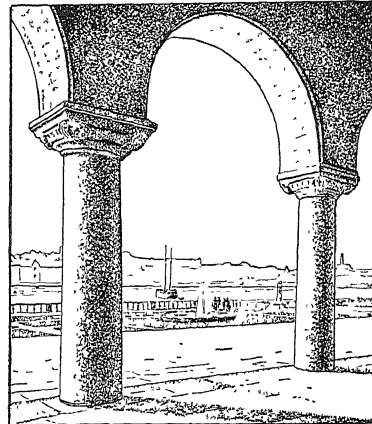


PARTS OF AN ARCH

known as the keystone, and the outermost or lowest two as the springers. The bottom line of the springers

is the block, sometimes molded, on which the arch is supported at each side. A continuous arch is called a vault.

The term arch is also used for a decorative element of arch form, and, technically, for the structure which supports the floors of a modern steel skeleton constructed building between the steel floor beams.



ROUND ARCH OF THE LOGGIA, TOWN  
HALL OF STOCKHOLM, SWEDEN

Curved arches of concrete are true arches, because, although homogeneous, they have a certain elasticity which exerts thrust. Similarly certain large steel trusses of curved shape are known as arched trusses, and have certain of the characteristics of an arch. See also TRIUMPHAL ARCH.

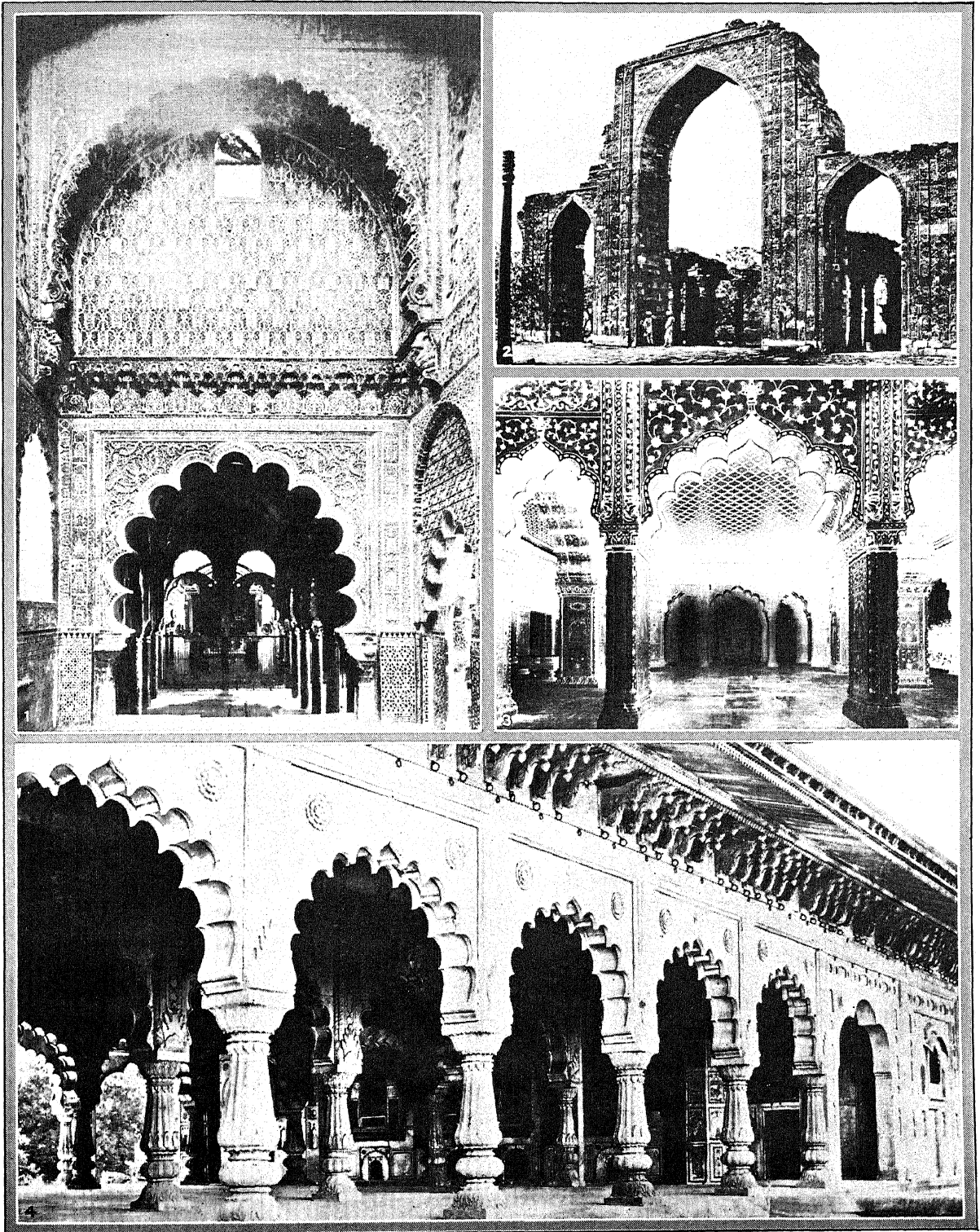
T.F.H.

**ARCHABBOT**, an honorary title conferred upon the heads of such Benedictine monasteries as are noted for their preeminence or antiquity. St. Vincent's Archabbey, Beatty, near Pittsburg, is one of the few in the world.

**ARCHAEOLOGICAL SITES**, places where discoveries have been made which throw light on the prehistory of man, these discoveries consisting of implements, weapons or other objects made by man, of human skeletons or parts of skeletons. There are thousands of archaeological sites, these being widely spread over the globe. Among the most notable, taken in the generally accepted order of their antiquity and beginning with the earliest, are: Foxhall, Ipswich and Piltdown, in England; Strépy in Belgium; Chelles-sur-Marne, Saint-Acheul and Le Moustier, in France; Mauer and Ehringsdorf in Germany; Gibraltar; Spy in Belgium; Aurignac, Solutré, La Madeleine, Le Mas d'Azil and Fère-en-Tardenois, in France; Krapina, in Yugoslavia; Predmost, Czechoslovakia; Capsa, or Gafsa, in Tunisia; Cogul, Alpera and Altamira, in Spain; Oronsay, Scotland, and Larne, Ireland. All these belong to the Stone Age. There are also important archaeological sites in Java, South Africa, Australia and China, and many in America. Sites of the BRONZE AGE and early IRON AGE are described under these headings.

**ARCHAEOLOGIST**, a scientific investigator of the artifactual history of the past. He must have

## ARCH

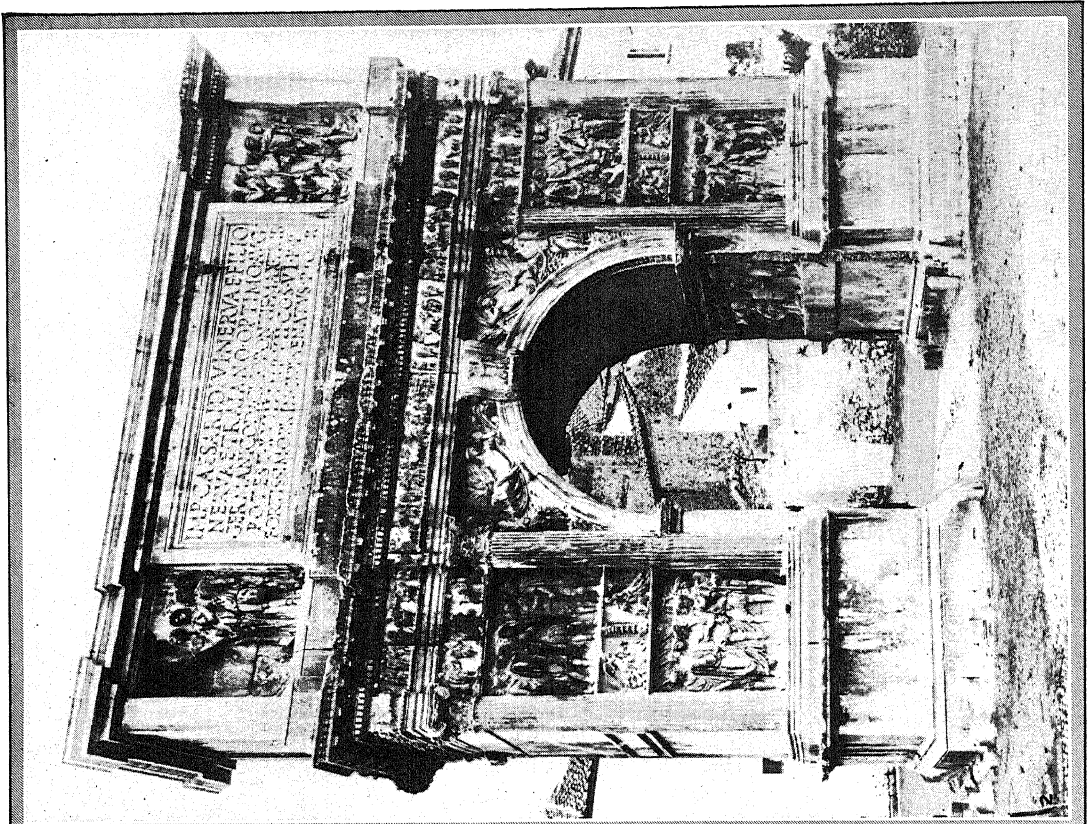
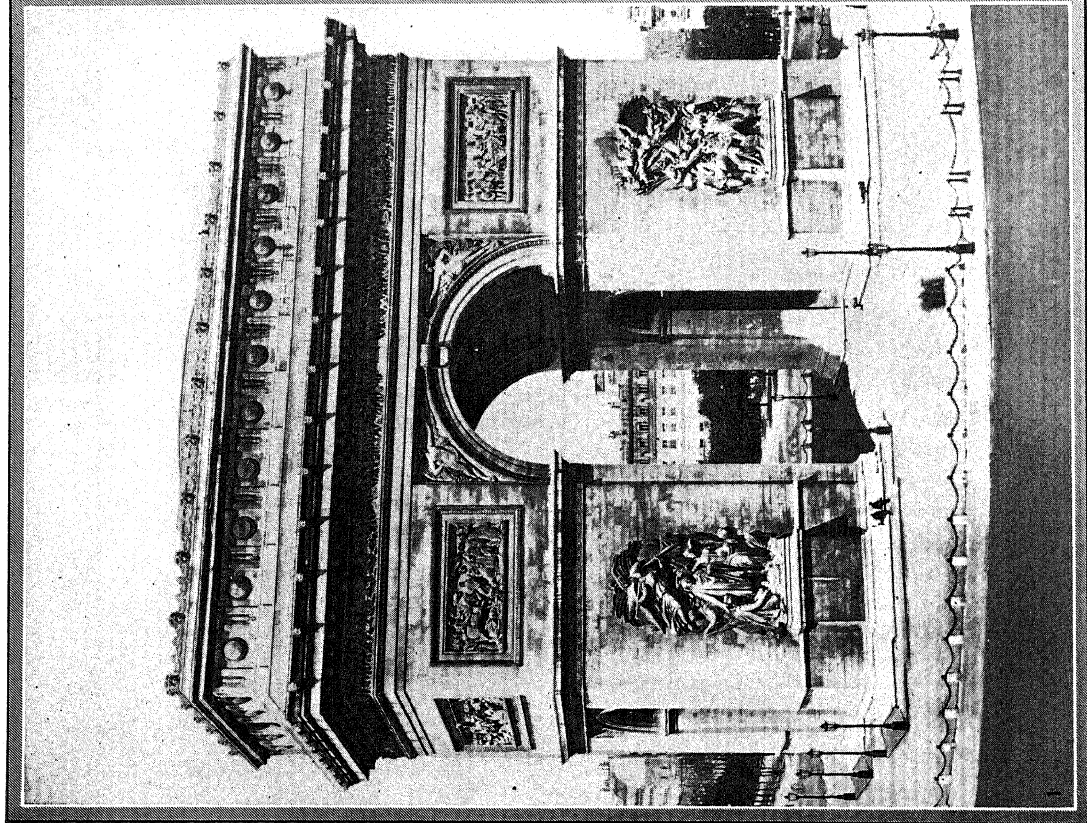


### VARIOUS ARCH FORMS

1. Interior of the Cathedral at Cordova, Spain, formerly a Moorish mosque (cusped and horseshoe arches). 2. Great Arch and Iron Pillar at Delhi, India (pointed arches, 4-cen-

tered, slightly oggee-ed). 3. The Diwan-i-Khas in the palace at Delhi, India (cusped, pointed arches). 4. The Nand Bhawan, a hall near the palace at Dig, India (cusped arches).





### CELEBRATED TRIUMPHAL ARCHES IN FRANCE AND ITALY

1. The Arc de Triomphe, Paris, erected in 1805 to commemorate the victories of Napoleon I. It was designed from the Arch of Severus, Rome.
2. Triumphal Arch of Trajan at Benevento in southern Italy, built in 115 A.D. The arch is of Greek marble, 50 ft. high with a passage of 27 ft.

command of many languages and be versed in literary history. He must have an eye for surface features in order to recognize unnatural ground changes; he must know GEOLOGY in order to date artifacts found in earth strata; he must have enough constructional knowledge to be able to prop up crumbling buildings. The archaeologist must be as deft with his fingers as a jeweler. He must know photography, surveying, ceramics, pigmentation, epigraphy and numismatics. The archaeologist should have great scientific zeal, be a scholar with imagination, and possess the self discipline to be a patient, meticulous, indefatigable researcher. R. VAN D. M.

**ARCHAEOLOGY.** The term archaeology has become more elastic than it was a generation ago. In the narrow sense it may refer only to the classical or historic portion of the subject. In the broad sense it may be used to include the great field of prehistory and protohistory. Historic archaeology has its roots in protohistory and continues up to the beginning of the Renaissance. Prehistoric archaeology is rooted in the geologic past and finally merges into the protohistoric. The subject has grown so rapidly during the past 100 years that various schools and societies have been established to foster research in special fields: at Athens, Jerusalem and Bagdad, Rome, etc., for historic archaeology; and the American School of Prehistoric Research with the Old World as its special field. For research in the New World there are two institutions with seats at Santa Fé: the School of American Research and the Laboratory of Anthropology. The latest development to foster cooperative effort the world over is the International Congress of Prehistoric and Protohistoric Sciences.

#### PREHISTORY OF THE OLD WORLD

The evidence thus far gleaned points to the Old World as the stage on which the first acts of the human drama were played. Let us examine for a moment the stage. It was ample in size. The greater part of the land mass lies north of the equator and in the hemisphere which suffered least from the recurring advances of the ice during the Glacial Period, thus leaving to man a larger stage for the great drama of physical and cultural evolution than he would have had in the western hemisphere. There is every reason to assume that the cradle of the human race was not only somewhere in the Old World but also north of the equator. Was it in that part now known as Europe? It is too early to answer this question definitely. We are, however, in a better position to discuss the prehistory of Europe than that of any other section of the Old World because more work has been done there than anywhere else.

Prehistory is unthinkable without a chronology; but its chronology is of a sort to which the finer units of the time scale, such as days, months and even years, are not applicable. Its chronology is measured by year units to be sure, but used in mass rather than singly; and when figures in terms of years are given, they must be considered as approximations, as is the

case when dealing with the Ice Age or with geologic time. This fact, however, does not reflect on the validity of prehistoric chronology, or on its scientific value.

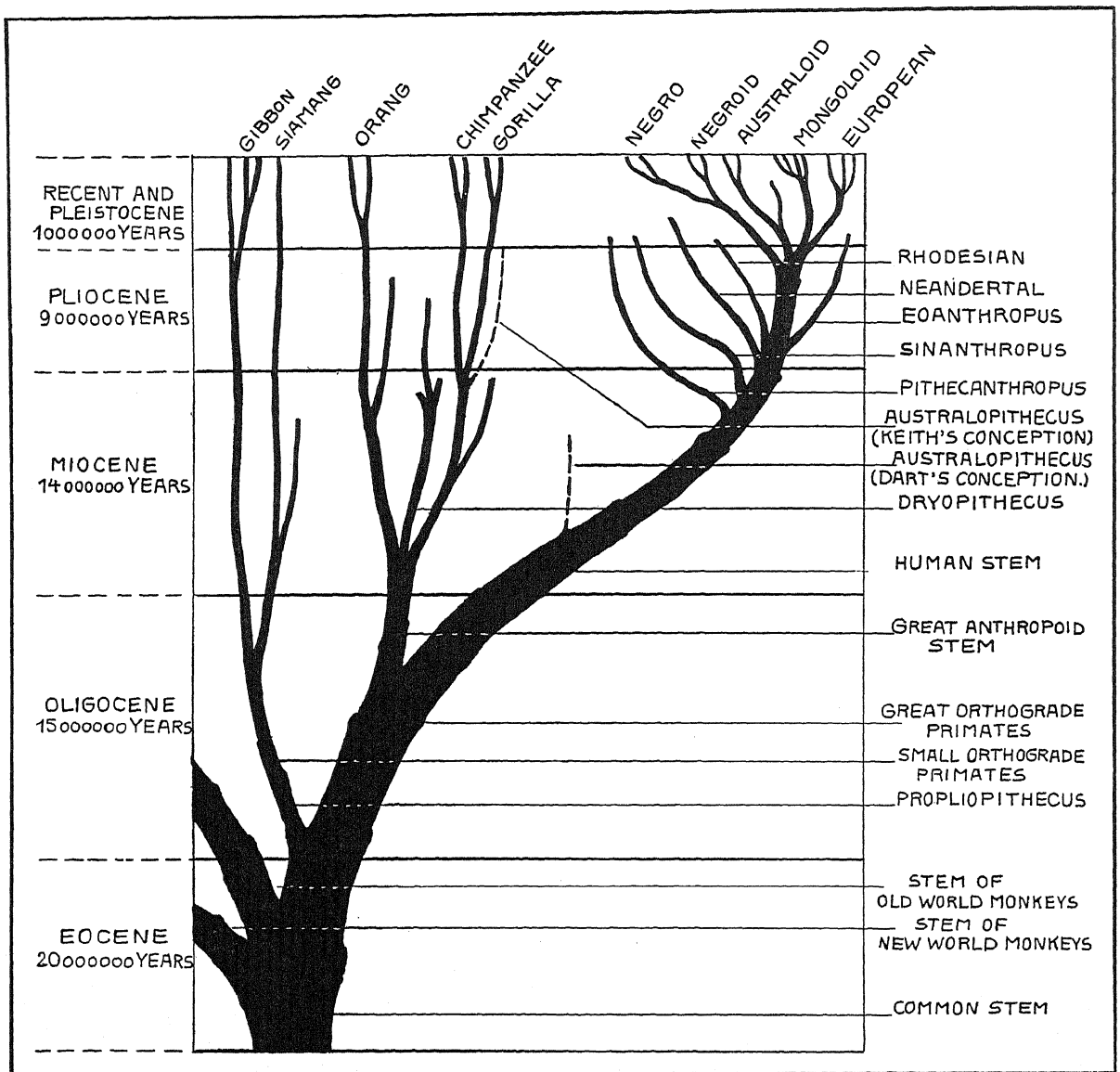
For years the general consensus of opinion was that the last phase of Mousterian culture was coincident with the advance of the Würm or last glaciation and that Upper Paleolithic (Aurignacian, Solutrean and Magdalenian) was coincident with a part of the maximum Würm glaciation and the major part of its retreat. Until very recently conservative prehistorians attempted to compress practically all of the Lower Paleolithic into the last interglacial, or Riss-Würm, epoch. In 1912 Commont had come to the conclusion that at least an early phase of the Chellean, or Pre-Chellean, should be placed in the next to the last, or Mindel-Riss, interglacial.

The recent progress in this direction is due largely to J. Reid Moir and the Abbé H. Breuil. The main points in Breuil's synchronism of European glaciations and European cultural epochs, slightly modified, may be tabulated as follows:

<i>Glacial and Interglacial Stages</i>	<i>Cultural Stages</i>		
Post-Wurm	Tardenoisian		
	Azilian		
Würm II	Final Magdalenian		
	Lower Magdalenian		
Laufen Retreat	Solutrean		
	Aurignacian		
Würm I	Final Mousterian		
	Levalloisian V	Mousterian	
Riss-Würm Interglacial	Levalloisian III-V	Early Mousterian	
	Micoquean	Grimaldi phase	
Riss	Weimar phase		
	Derived and worn specimens of earlier cultures		
Mindel-Riss Interglacial	Upper Acheulian	Levalloisian II	Glactonian
	Middle Acheulian	Levalloisian I	
Mindel	Lower Acheulian	Micoquean	
	Derived and worn specimens of earlier cultures		
Günz-Mindel Interglacial	Chellean	Early Micoquean	Base of Glactonian
	Pre-Chellean		
Günz Pre-Günz	Sub-crag industry		Eolithic of some authors

The foregoing tabulation covers only the first great period of prehistory, the so-called PALEOLITHIC PERIOD, and the first two stages of the MESOLITHIC PERIOD, viz., the Azilian and Tardenoisian. To complete the Mesolithic, also called Epi-Paleolithic, there are usually added the MAGLEMOSEAN PERIOD, the Shell Heap culture and the Campignian of some authors. Following the Mesolithic comes the NEOLITHIC PERIOD to complete the cycle of STONE AGE cultures.





DIAGRAMMATIC REPRESENTATION OF HUMAN AND APE EVOLUTION  
Based on Sir Arthur Keith's chart, with changes by the author

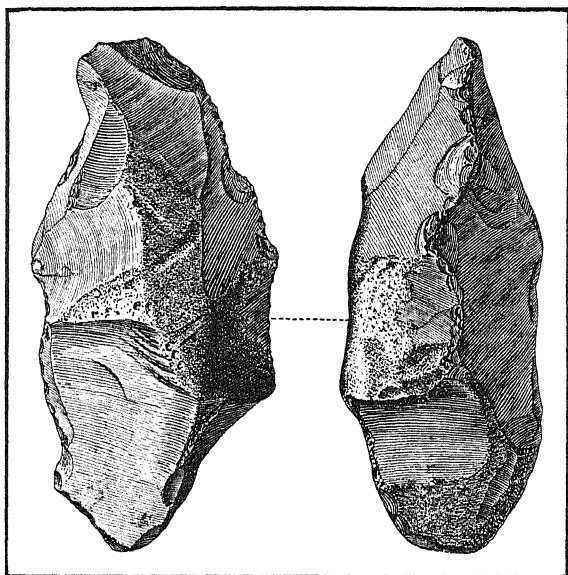
The use of the term Stone Age should not leave it to be implied that stone was the only kind of raw material on which primitive man drew for his tools and weapons. Use was made of many other materials such as wood, bone, horn and ivory. Stone was the most durable of all these materials, so that specimens of man's handiwork in stone were more likely to persist. The fact is that throughout the Paleolithic Period artifacts of stone far outnumbered those of any other material. They form the best available data for dividing Paleolithic time into epochs. Not until the Neolithic Period and the invention of pottery did any other medium dispute first place with stone in tracing the evolution of man's material culture.

The evidence bearing on human evolution is of two kinds, cultural and physical, namely, the remains of man's handiwork and of his body. The latter are confined practically to his skeleton. Both cultural and human evolution were very slow at first; physical evolution has continued to be so. On the other hand, cultural evolution has gradually increased in rapidity until now we are accustomed to see revolutionary changes in a single generation. Cultural evolution therefore is a more delicate instrument with which to delimit the various successive stages into which prehistoric time may be divided.

The chronology of prehistory is based on stratigraphy, on the superposition of relic bearing deposits. This superposition may occur in valley and loess de-

posits, in the floor deposits of caves and rock shelters, and in prehistoric camp or dwelling sites wherever located. The stratigraphically determined data may also be used to fix the dates of burials, hoards and isolated finds.

Among all the kinds of stone employed by Paleolithic man, flint played a dominant rôle. It had the advantage of being abundant, widely distributed and of a quality best fitted to the manufacture of tools and weapons. Flint belongs to the family of cryptocrystalline quartzes; it has a semi-vitreous luster and a hardness greater than that of steel. It fractures readily through both percussion and pressure. The conchoidal nature of its fracture made it easily adapt-

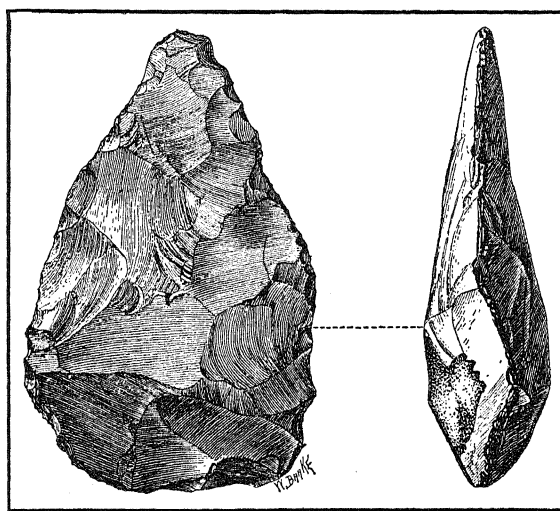


FLINT TOOL FOUND IN SECOND TERRACE (THIRD FROM THE RIVER) ON THE ROUTE DE BOVES AT ST. ACHEUL IN THE SOMME, FRANCE. PRE-CHELLEAN EPOCH

able to primitive man's need for a cutting instrument. Moreover, it may be fractured through purely natural means, and it was probably the use of these natural flakes with sharp edges that first led man to produce similar flakes at will. The artificial flakes may be distinguished by their bulb of percussion.

**Paleolithic Period.** Eolithic is the name that should be reserved for artifacts that can be referred definitely to the Tertiary Epoch. The Paleolithic is practically coextensive with the Pleistocene Epoch and the Ice Age. It has been subdivided into Pre-Chellean, Chellean, Acheulian, Mousterian, Aurignacian, Solutrean and Magdalenian epochs. Recently the Abbé Breuil has added two new terms: the Glactonian, between the Chellean and Acheulian; and the Levalloisian, between the Acheulian and Mousterian. The foregoing table of chronology will show the position of each of these epochs in relation to the various phases of the Ice Age. The epochs are also characterized by certain types of stone implements as regards both form and methods of manufacture.

**Chellean Epoch.** Implements of Pre-Chellean Age are crude in workmanship. Distinctive types are lacking. Not many sites that can with certainty be referred to this phase are known. Among them may be mentioned the Cromer forest bed in Norfolk, Saint-Acheul (Somme), and perhaps La Chalosse (Landes). On the other hand the Chellean industry is characterized by a type called by the French *coup-de-poing*, in English, hand ax, and in German, *Faustkeil*. The oldest hand axes are crudely chipped on both faces, pointed at one end and rounded at the other, the two faces meeting along a sinuous margin. The rounded end or poll is relatively thick and often retains some of the nodular crust when made of flint. Chellean culture is widespread over the Old World, especially in middle latitudes and those nearer the



A PREHISTORIC HAND AX

A hand ax of flint found in the lower gravels of the third terrace (second from the river) in the Boutmy-Muchembled pit at Moutiers, near Amiens (Somme), France. Chellean Epoch

equator. In addition to the hand ax one finds scrapers, points, spokeshaves, etc., chipped on one face only. See also CHELLEAN CULTURE.

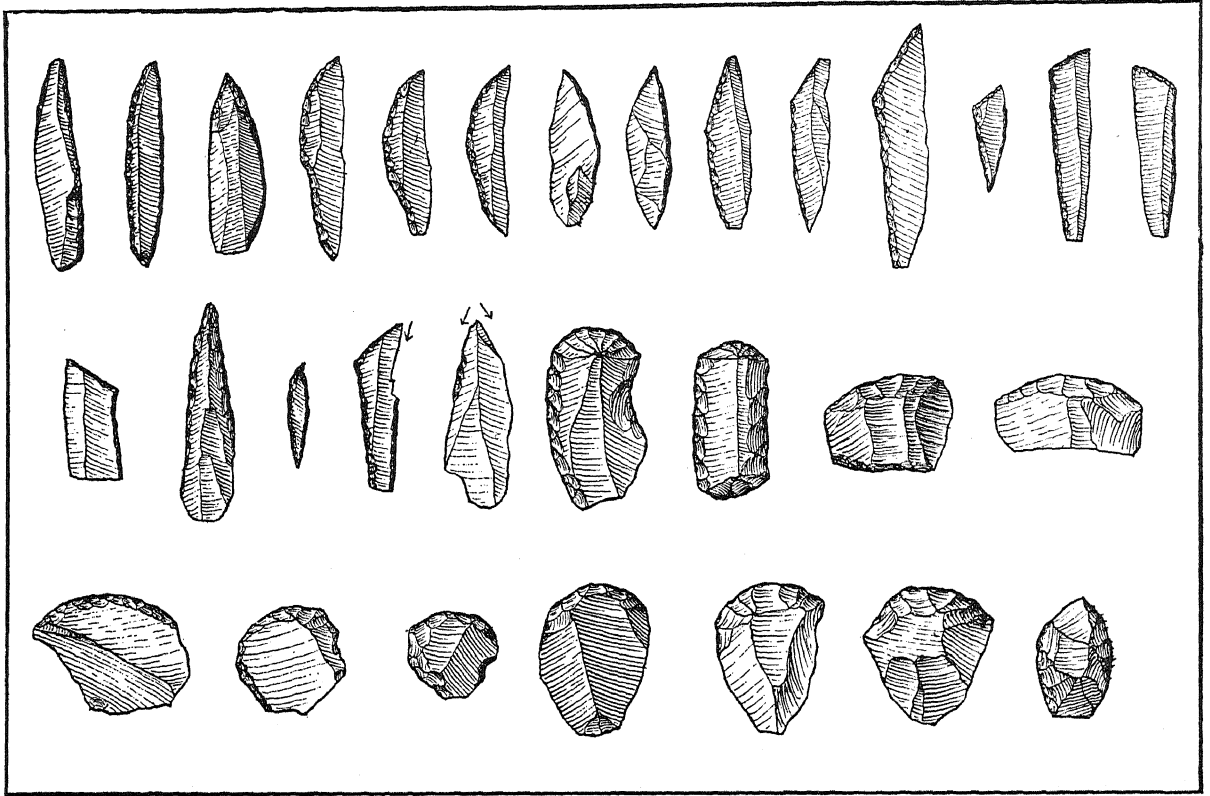
**Acheulian Epoch.** Acheulian culture is simply a refinement of the Chellean. The hand axes are more deftly made. The sinuosity of the margins is much less pronounced, and the poll is not so thick. There is also an accompaniment of smaller tools chipped on one face only. Everything points to a very slow but consistent evolution of human culture in western Europe throughout the Pre-Chellean, Chellean and Acheulian epochs. The physical character of the races responsible for this Lower Paleolithic culture is revealed in such fragmentary remains as the lower jaw from near Heidelberg, the Piltdown remains and perhaps also those recently discovered at Chou Kou Tien, near Peking. See also ACHEULIAN CULTURE.

**Mousterian Epoch.** The Mousterian Epoch marks a continuation of the Lower Paleolithic culture, so much so that it might well be classed as the final epoch of the Lower Paleolithic Period rather than

being referred to as the Middle Paleolithic Period. The hand ax persisted and is found even in the upper levels of the Mousterian deposits. The scraper and point not only persisted but also became the dominant Mousterian types. The Mousterian culture likewise includes a few artifacts of bone. The race which left the Mousterian culture is the so-called Neandertal race. The Neandertal skeleton was found in 1857. No artifacts were found with it. In 1864 it was chosen as the type specimen of a species of fossil man, to which King gave the name *Homo neandertalensis*. Five years later, de Mortillet chose Le Moustier (Dordogne) as the type station for a cultural epoch, to

tore and Kiik-koba, to Spy, La Chapelle-aux-Saints, La Ferrassie, Galilee, etc. According to G. Elliot Smith and Pycraft, Rhodesian man from Broken Hill stands at the parting of the ways between Neandertal man and the more modern types which followed. G. Elliot Smith's conclusion is based on the brain cast, and that of Pycraft is based on the character of the pelvis.

The most pronounced line of cleavage, both as respects physical evolution and cultural evolution, is that between the Mousterian or Middle Paleolithic and the Aurignacian, or the initial stage of the Upper Paleolithic. Up to this time, man's kit of tools was



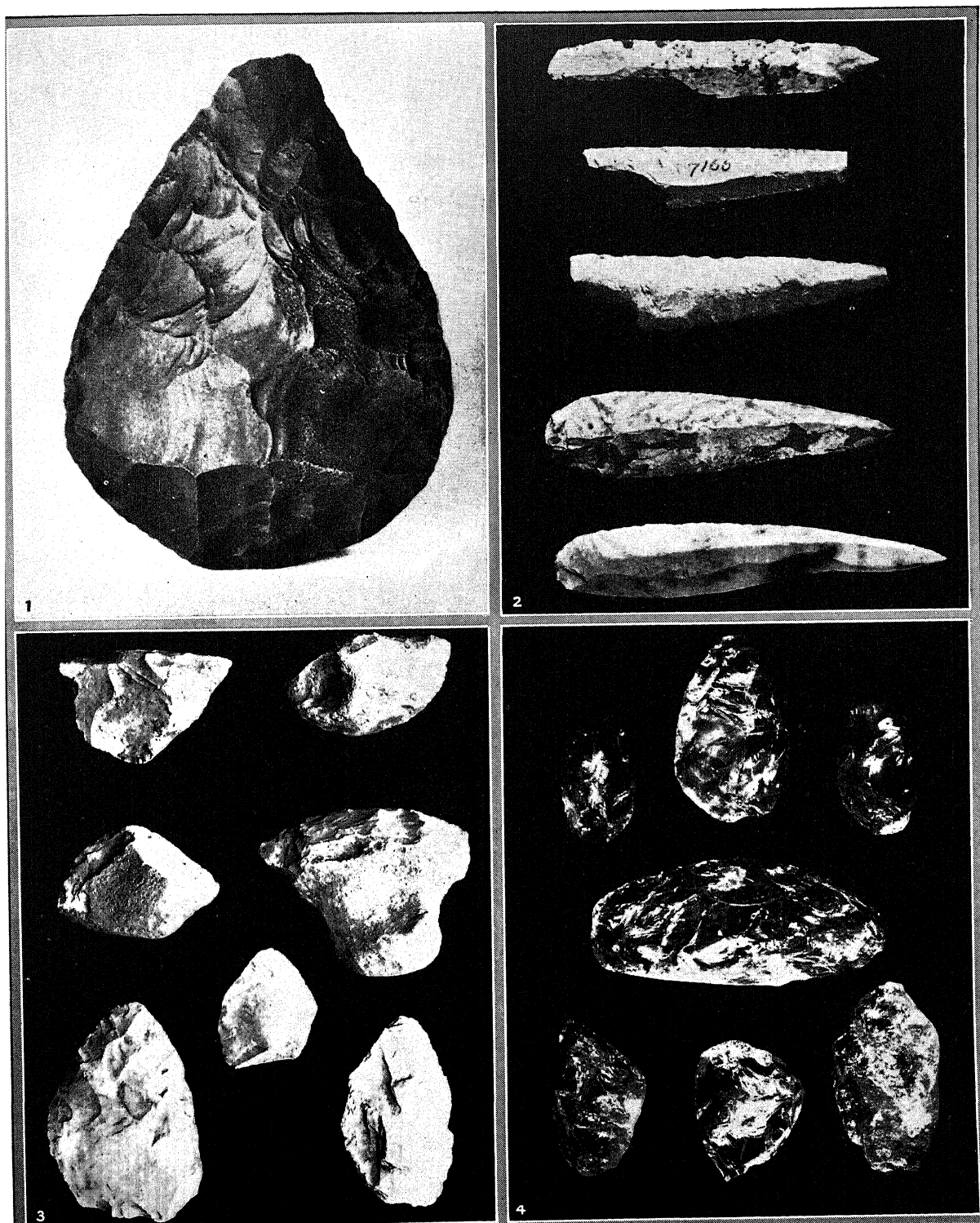
FLINT TOOLS FROM THE CAVE OF ZARZI, NEAR SULAIMANI, IRAQ. AURIGNACIAN EPOCH

which he gave the name Mousterian. Up to that time, no human skeleton had been found in association with artifacts. Such a happy combination, however, did come to light at Spy (Belgium) in 1886, where two human skeletons of the Neandertal type were found in association with artifacts of the Mousterian type. But by that time it was too late to alter the appropriate terminology already in use. The race therefore remains Neandertal and its culture Mousterian.

Parts of many Neandertal skeletons have been found since 1886 and generally in association with artifacts, always of the Mousterian type. Starting with the man of Heidelberg as a prototype, there is now a fairly comprehensive series leading up through the specimens from Ehringsdorf, Krapina, Saccopas-

very simple indeed, consisting largely of ready-to-hand tools supplied by nature, such as the hammer-stone and natural flake with cutting edge, and tools that could be fabricated by the art of chipping. These two classes of tools I have called primary and secondary respectively. With the coming of the new race, commonly referred to as the race of Cro-Magnon, we find a new kit of tools. While the Cro-Magnons still made use of primary and secondary tools, they produced in addition a new set of tools, to which the term tertiary might well be given; such for example as the needle of bone or ivory, the dart thrower, and the harpoon of reindeer horn.

There is also to be noted a marked evolution in the lithic industry. Nuclei were prepared from which long blade-like flakes were struck. Out of these,



COURTESY GEORGE GRANT MACCURDY, YALE UNIVERSITY

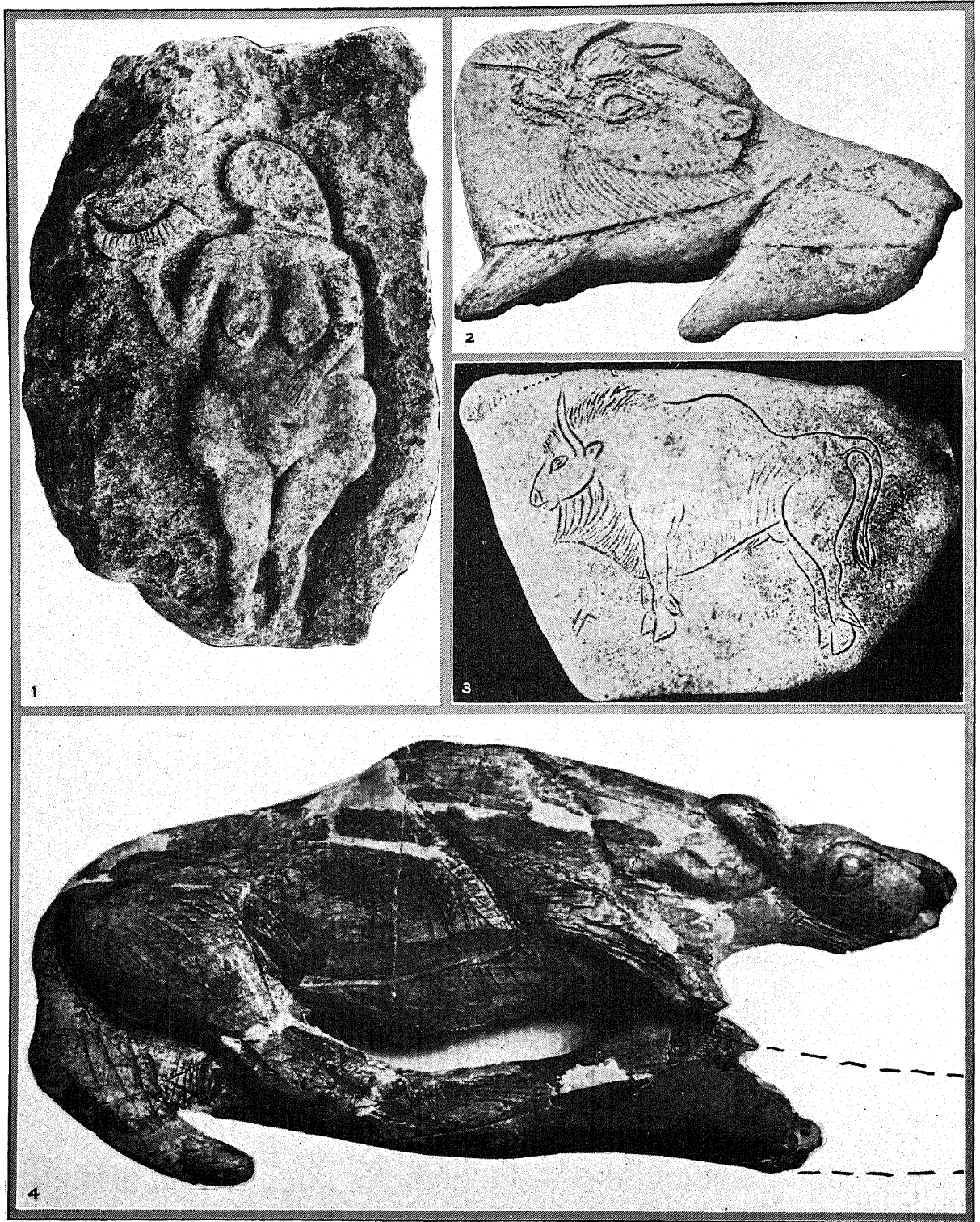
## PREHISTORIC WEAPONS AND TOOLS

1. Hand ax of flint from Mutallah, headwaters of the Jordan. Acheulian Epoch. 2. Flint points of the Solutrean Epoch. 3. Flint scrapers and hand axes from the Abri des

Merveilles, Sergeac, France. Mousterian Epoch. 4. Scrapers and points of Spanish topaz, from the Abri des Merveilles. Mousterian Epoch.



## ARCHAEOLOGY



COURTESY GEORGE GRANT MACCURDY, YALE UNIVERSITY

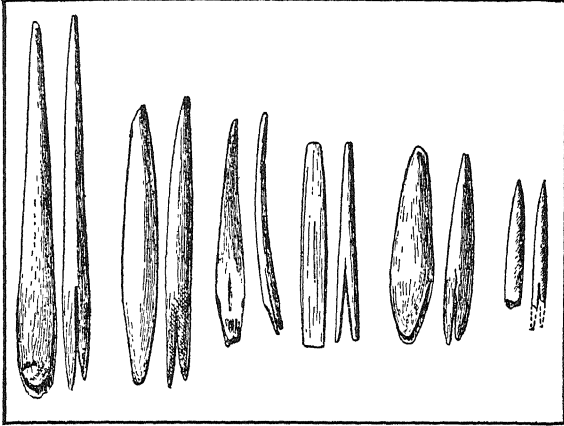
### PREHISTORIC CARVINGS FOUND IN FRANCE

1. The "Venus of Laussel" from the rock shelter of Laussel near Les Eyzies. 2. Bison carved as a decoration for a dart thrower. Magdalenian Epoch. 3. Bison incised on lime-

stone, from the rock shelter of Langerie-Basse, in the Dordogne. Magdalenian Epoch. 4. Animal figure of ivory. Magdalenian Epoch.

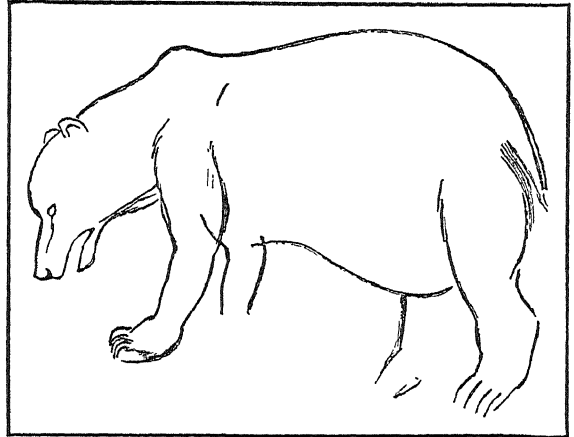
gravers, scratchers and knives were made. The gravers were employed not only in the cutting of bone, ivory and reindeer horn but also by the artist in the production of engravings and figures in relief and in the round. The Cro-Magnon artist also knew how to employ color in giving expression to his artis-

laurel leaf blade deftly chipped on both faces to produce an implement about three times as long as its maximum breadth and everywhere reduced to a remarkable degree of thinness. The maximum breadth is always nearer to the less pointed of the two ends. The laurel leaf characterizes the Lower Solutrean;



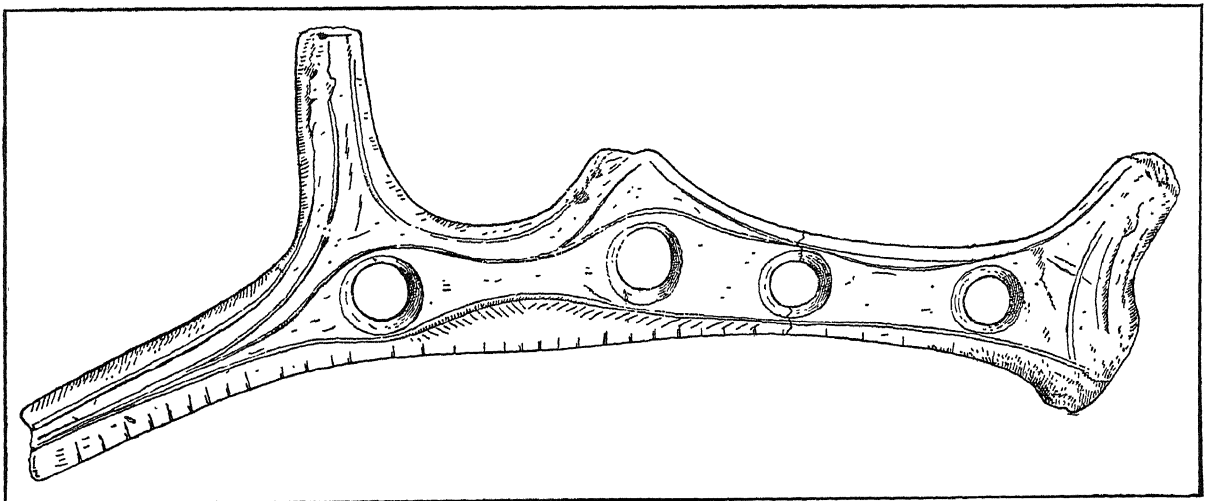
POINTS WITH CLEFT BASE MADE OF BONE, IVORY AND REINDEER HORN, FROM THE CAVE OF LES COTTES, VIENNE, FRANCE, AURIGNACIAN EPOCH

tic impulses. If he was skillful with the graver he was likewise skillful with the crayon of ocher or manganese, as witness the drawings on the walls and ceilings of caves. Before the close of the Magdalenian Epoch, he had also become adept in the blending of



A MURAL ENGRAVING OF THE CAVE BEAR FROM THE CAVE OF LA MARIE AT TEYJAT, IN THE DORDOGNE, FRANCE. MAGDALENIAN EPOCH

while the Upper Solutrean is characterized by a relatively small pointed implement with a single lateral notch at the base. In some only one face is retouched and in some both faces are retouched. This implement can be compared in shape to the willow leaf.



BATON OF REINDEER HORN FROM THE ROCK SHELTER OF LA MADELEINE, IN THE DORDOGNE, FRANCE. MAGDALENIAN EPOCH

colors as seen in the remarkable polychrome frescoes at Altamira, Font-de-Gaume and elsewhere. *See also* AURIGNACIAN CULTURE.

*Solutrean Epoch.* Upper Paleolithic culture forms a more or less cohesive whole. The principal exception to this rule is represented in the lithic industry of the second epoch, known as the Solutrean. During the Solutrean Epoch there appeared first the

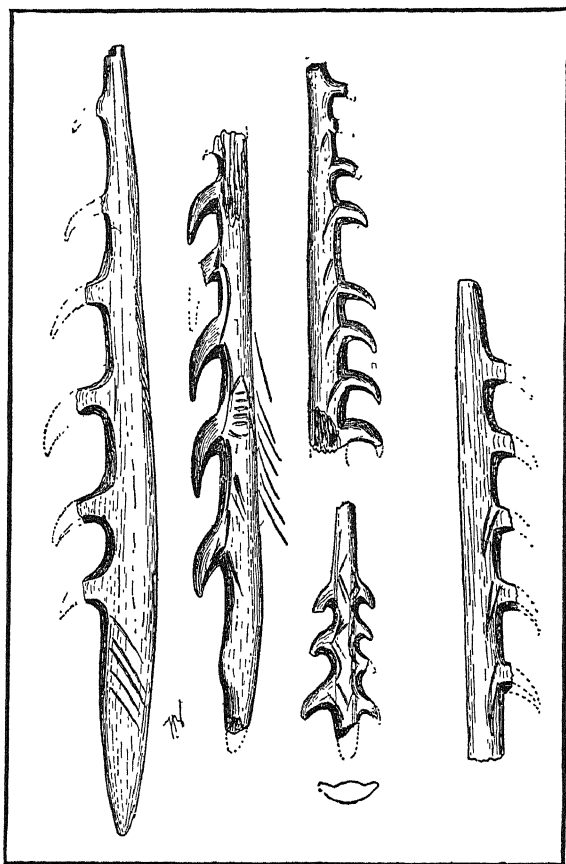
With the Solutrean laurel leaf and willow leaf, Paleolithic chipping of flint reached its apogee. *See also* SOLUTREAN CULTURE.

*Magdalenian Epoch.* The lithic industry during the Magdalenian Epoch offers very little that is new. The laurel leaf and willow leaf did not carry over into the Magdalenian. On the other hand the graver, which had its origin in the Aurignacian, persisted



not only through the Solutrean, but also through the Magdalenian. One type of graver, the parrot beak, is found only in the Magdalenian. The microlithic industry which appeared in the Aurignacian is to be found in both the Solutrean and the Magdalenian epochs.

An industry in non-lithic materials came to the fore during the Aurignacian and continued to be much in evidence until the end of the Magdalenian. In the Aurignacian Epoch there appeared the flat bone point with base cleft for hafting. With this



HARPOONS OF REINDEER HORN FROM THE CAVE OF LA MARIE AT TEYJAT, IN THE DORDOGNE, FRANCE. MAGDALENIAN EPOCH

there went a dart thrower usually carved out of reindeer horn, also the baton of reindeer horn and the needle of bone or ivory. The first needle with an eye appeared in the Upper Solutrean. During the Magdalenian Epoch, needles of fine workmanship were comparatively plentiful.

Breuil has been able to distinguish six phases or levels in the Magdalenian deposits, largely through a study of the non-lithic industry. The evolution of the javelin point is especially instructive. The first phase is characterized by a heavy, thick based lanceolate form made of reindeer horn; in the second phase the base becomes flattened; in the third the base is either conical or beveled and the shaft grooved, the

bevel at first being single and later double; the fourth witnesses a lengthening of the grooves and the appearance of tubercles near the base. The javelin point with forked base appeared in the Pyrenees during the fourth phase but not in Dordogne until the fifth phase. During the fourth phase there appeared prototypes of the harpoon of reindeer horn, the evolution of which was completed during the fifth and sixth phases. *See also MAGDALENIAN CULTURE.*

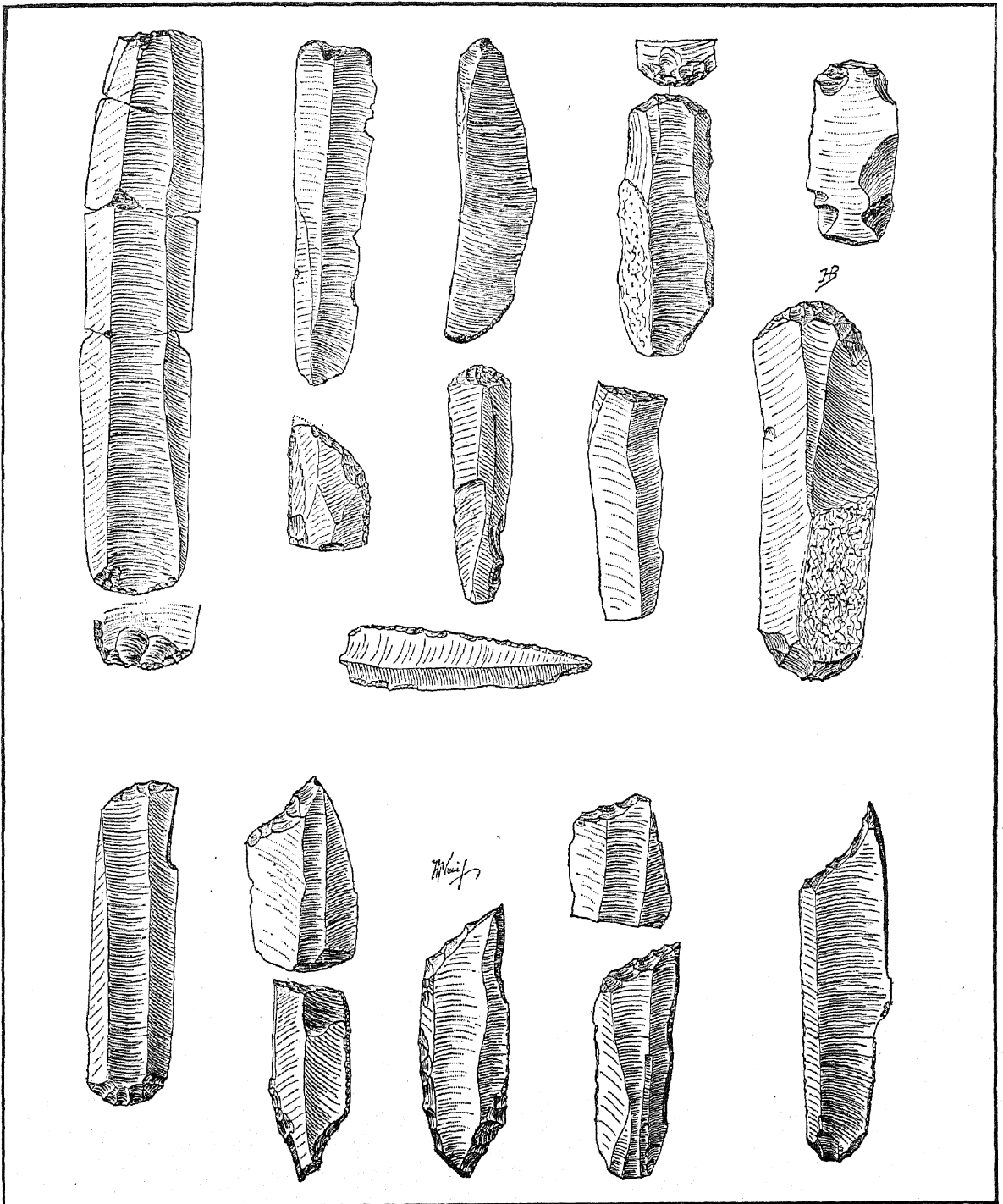
*Paleolithic Art.* Cave art made its appearance with the Aurignacian and continued through to the end of the Magdalenian. With the recent discoveries of Peyrony at Le Fourneau-du-Diable (Dordogne) and of Henri Martin at Le Roc (Charente) we now have indubitable proof of Solutrean art.

Breuil has made a special study of the evolution of cave art and recognizes at least four phases. The first phase is represented by figures in the round, rather deeply incised engravings and drawings in outline. The figures are in absolute profile and practically devoid of detail. The incised figures of the second phase remain deep and broad; but the outlines are more lifelike. All four of the legs are usually represented, sometimes the hoofs also, as well as other details lacking in the first phase. Drawings in color of the second phase evince the first attempt at modeling by shading at certain points, but the figures continue to be monochrome. The engravings of the third phase are generally of small dimensions and admirable in execution. During the fourth phase engravings lose in importance. On the other hand Paleolithic painting reached its zenith in this phase. The modeling is done with various shades produced by the mixing of yellow, red and black. In the frescoes and drawings in color, use was made of oxide of iron and of manganese.

The cave artist became adept not only in his use of such media as stone, bone, horn and ivory but also in the use of clay. He has left outlines of animal figures in the clay of the cavern floors, done with the finger tips or pointed sticks, and fortunately preserved to our time because of their sheltered positions. He also modeled in clay, the best examples of this sort being the clay bison in the cavern of Tuc d'Audoubert (Ariège).

The cave artist's range of models included both the animate and inanimate, but was confined almost wholly to the fauna. Mammals, including man, largely monopolized his attention. Birds and fishes were not so largely represented; reptilian figures are rare and the same may be said of invertebrates. Plantlike forms are also rare. The inanimate world is represented by club-shaped and tent-shaped figures, by spirals, circles, chevrons, frets, volutes, wave ornaments and alphabetiform signs, of which some at least were derived from animate objects through processes of conventionalization.

To the hunter, game animals would naturally loom large on the horizon; these occur much more frequently than any other kinds. The horse far outnumbered the hyena, as does the red deer the lion.



SCRATCHERS AND GRAVERS OF FLINT FROM THE CAVE OF LA MARIE AT TEYJAT, IN THE DORGOGNE, FRANCE. MAGDALENIAN EPOCH

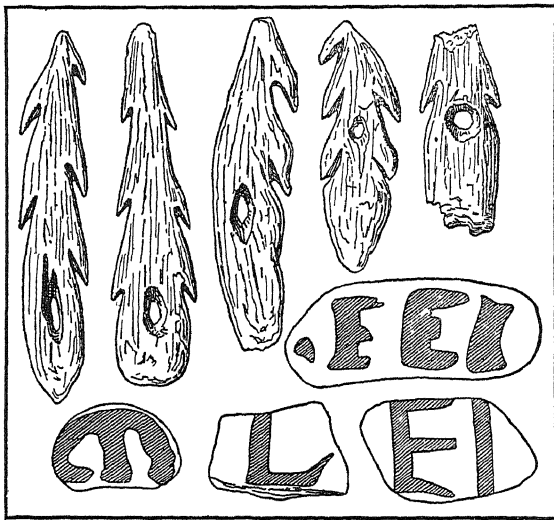
Many of the animal figures are prayers for the increase of the herd. The cave artist not only had predilection for such species as the horse and reindeer; he also seems to have had a predilection for the female of the species. The hind is represented

more often than the stag and the human female more often than the male.

*Mesolithic Period.* This is also known as the Epi-Paleolithic Period and in some respects may be looked upon as the Dark Ages of the Prehistoric era. That

which made of the Paleolithic what it was in Magdalenian times lost its hold for some reason, and there seems to have been nothing quite so effective to take its place. A change of climate no doubt had at least something to do with the result; blood and a difference in the cultural background, if there were shifts in these respects, may also have had an effect. The art of the cave-man disappeared along with that which had been its inspiration, and nothing of real consequence arose to take their places. Cultural evolution waited for a renaissance, which was destined to come with the domestication of animals and plants and the invention of pottery; this ushered in a period justly called the Neolithic to be discussed in subsequent pages.

The Mesolithic Period has been subdivided into a number of epochs; or perhaps phases would be a bet-



FLAT HARPOONS OF STAG HORN AND PAINTED PEBBLES FROM MAS D'AZIL, ARIÈGE, FRANCE. AZILIAN EPOCH, MESOLITHIC PERIOD

ter term, since they do not apply to a well-defined sequence of cultures. In parts of central and western Europe the term Azilian is given to the Lower Mesolithic, and Tardenoisian to the Upper Mesolithic. In northern Spain the term Asturian is applied to the Upper Mesolithic. The Maglemosean of Denmark probably represents the earliest phase of the Mesolithic in that region. The final stages of the Mesolithic now include the Shell Heap and Campignian cultures previously assigned to the Neolithic Period.

The Mesolithic takes the place of what was once supposed to be a hiatus. The first span to bridge the hiatus was erected by Piette when he explored the station on the left bank of the Arise at Mas d'Azil. Work was begun there in 1887, and Piette was soon able to distinguish nine different culture levels. The first five were Paleolithic, the last three were Neolithic, while the sixth did not fit into either. To this level he gave the name Azilian. In this deposit bones of the stag were plentiful, but those of the reindeer

were absent. The lithic material was nondescript: small blades of flint, small discoidal scrapers, and pebbles that had served as chisels and paring knives. Last but not least were the flat harpoons of staghorn with perforated base and the so-called painted pebbles. By 1891 Piette had found more than 200 of these painted pebbles. Since then many Azilian stations have been found in western Europe; but nowhere else have so many painted pebbles been found as at the type station of Mas d'Azil.

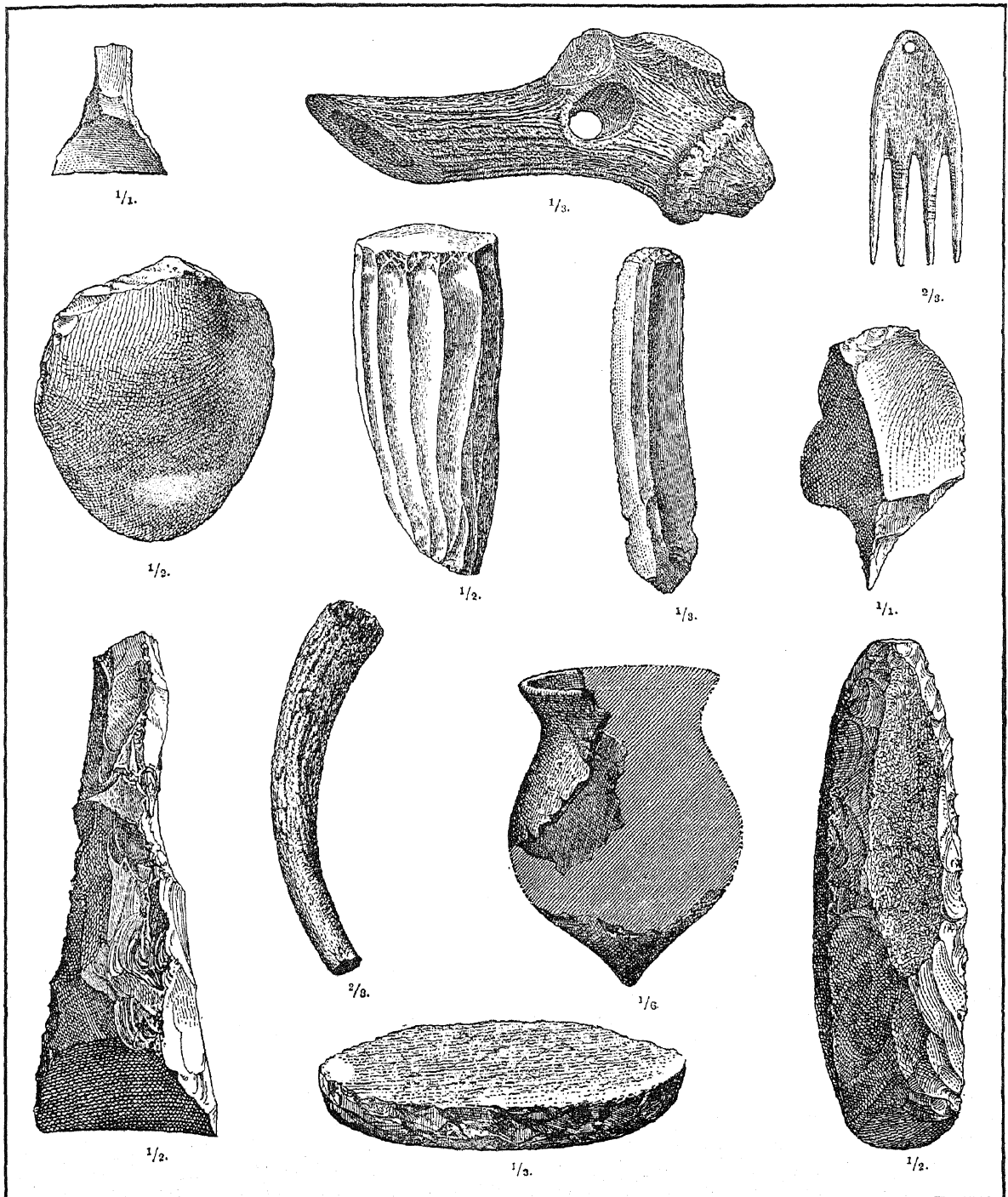
The chief difference between the Azilian and the Tardenoisian cultures is the absence of painted pebbles in the latter. The microlithic industry forms the dominant note throughout the Tardenoisian phase of the Mesolithic. Many of the microliths fall into geometric types, as triangles, trapeziums and crescents. There is an abundance of scrapers, also small blades recalling in miniature certain Aurignacian types (Chatelperron and La Gravette). Microliths were employed as an armature set longitudinally and bilaterally into bone points. Composite implements of this kind are also found in Maglemosean stations. That there was an overlapping of Azilian and Tardenoisian cultures is proved by the finding in the cave of Valle, northern Spain, of Azilian and Tardenoisian tools in the same layer.

Maglemosean culture developed in Scandinavia probably before the close of the Tardenoisian phase. The two cultures have much in common, especially the composite implement made of bone with an armature of microliths. The geographic distribution of the Maglemosean is, however, much more restricted than that of the Tardenoisian. The best-known Maglemosean stations are Mullerup in the Maglemose (great bog), Svaerdborg, Holmegaard and Bloksbjerg, all in Denmark.

Asturian culture takes its name from the province of Asturias, Spain, where it was first recognized. It is probably a local and rather late phase of the Mesolithic and closely related to the shell heap phase. In fact, Asturian industry is found in kitchen middens composed largely of sea shells carried into the caves. The typical Asturian tool is the pick chipped to a crude point from an oval pebble. Tools of bone are few and of crude workmanship. The Asturian is proved younger than the Azilian, because when the two are found in a given state, the Asturian is invariably on top of the Azilian.

The Shell Heap and Campignian cultures were formerly assigned to the Neolithic Period. The shell heap sites are on and near the present shore lines. They are, as the name indicates, great masses of shells left over from the shellfish consumed by the people of that time. The stone implements found in the shell heaps include (1) a triangular type with transverse edge and varying in size from an arrowhead to a hatchet, and (2) a pick. No polished stone implements are found. The pottery is crude with rounded or pointed bottom. Awls and chisels of stag antler occur, as do objects of bone.

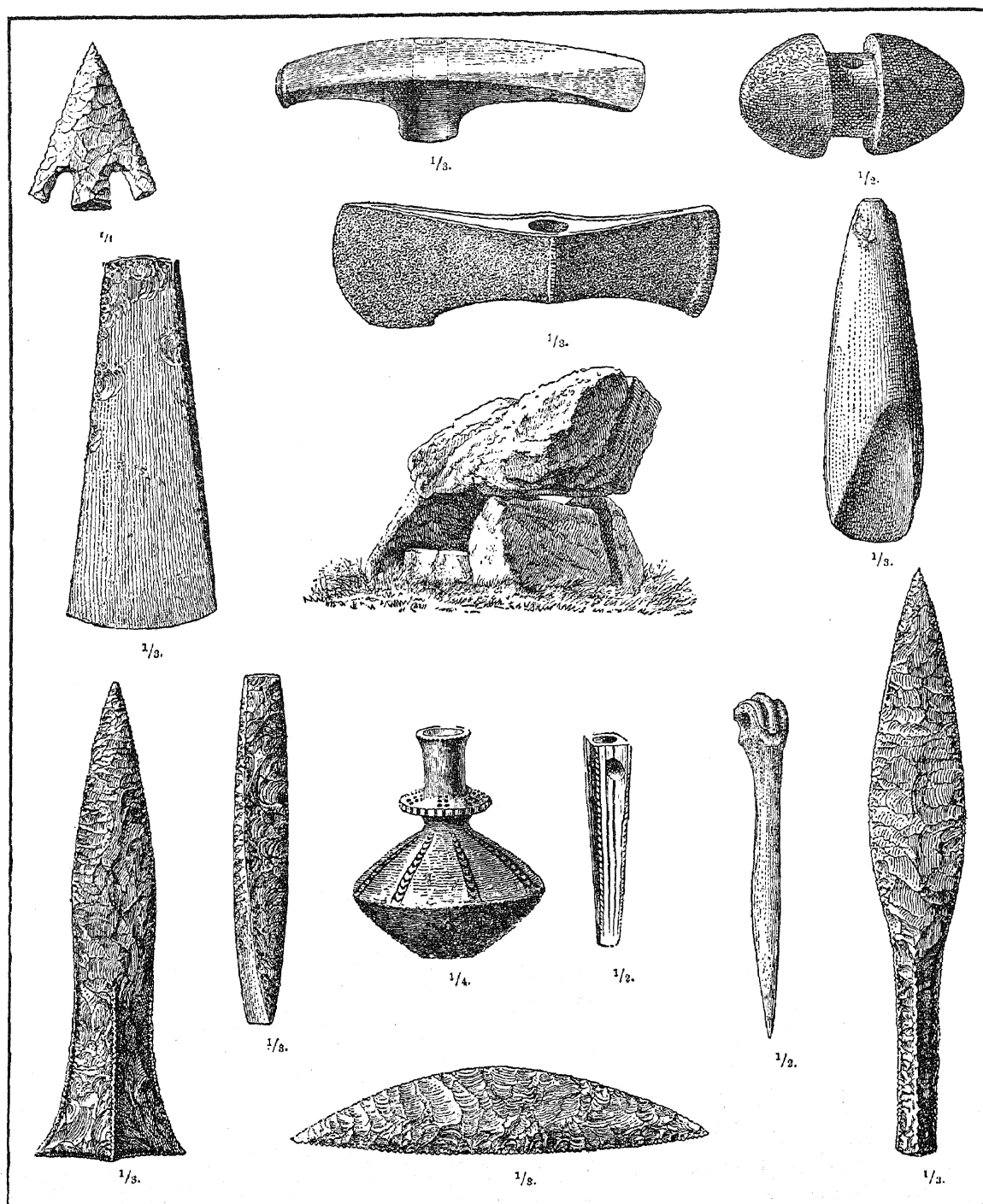
In all ages food, shelter and clothing have been



FLINT, BONE AND HORN ARTIFACTS AND A CLAY VESSEL FROM DENMARK. LATE MESOLITHIC AND EARLY NEOLITHIC PERIODS

man's prime desiderata. All are profoundly influenced by locality and climate. As far as the food supply is concerned dwellers by the sea are dependent largely on shellfish, hence their kitchen middens are composed largely of shells. At a much earlier epoch (interglacial) the race that inhabited caves in the

Alps at high elevations were restricted almost wholly to the cave bear for food, and their kitchen middens are composed largely of cave bear bones. Before the end of the last glacial epoch, and the final disappearance of the mammoth from central Europe, a race of hunters living in the open near what is now Unter



ARTIFACTS OF STONE AND BONE, A CLAY VESSEL, A DOLMEN, ETC., FROM DENMARK. NEOLITHIC PERIOD

Wisternitz, Czechoslovakia, was limited in its available food supply to the mammoth. We know this because of the predominance of bones of the woolly elephant in the kitchen middens left by them and at a later period covered up by loess deposits and so preserved.

**Neolithic Period.** Cultural evolution is continuous; its rate of progress has varied with environmental and racial changes. In the stream of cultural evolution there are rapid alternating with long stretches in which the current is barely perceptible. Through the ages the stream has widened and deepened largely

through tributaries. Tables of chronology are simply charts helpful to the navigators who would explore this stream of human evolution. As has already been noted, the dividing line between the Mousterian and the Aurignacian Epoch is marked by rapids in the stream. Equally marked are the rapids on the line dividing the Neolithic Period from the pre-Neolithic. Until the Neolithic stage was reached, man had been a food gatherer. With the Neolithic he became a food producer. While not wholly giving up hunting and fishing, he was no longer dependent on these sources of food, as well as raiment, supply. New inventions and discoveries made it possible to control the needed supply of raw materials, at the same time making possible profound changes in man's mode of life.

The factors which changed so rapidly the whole aspect of civilization were the domestication of animals and plants and the invention of the ceramic and textile arts. It would be difficult to determine which of these factors was the first to be controlled. The existence of any one of these factors calls so forcibly for all the others, the probability is that the development of all four fields was nearly simultaneous. In animal husbandry, plants are indispensable and vice versa. Both these industries require storage vessels, which would be supplied through the development of the ceramic and textile arts. All four factors combined to encourage community life with all that it meant toward subsequent progress of civilization.

Pottery and textiles furnished new and admirable media for satisfying the artistic impulses of the Neolithic races; in both the opportunity to cultivate art for art's sake had free course. During the Neolithic Period, the chipping of flint was carried to the point of becoming a fine art. This is seen to best advantage in the flint poniards and knives of Egypt and Denmark, as well as in some of the beautifully chipped blades found in the New World.

The polishing of stone tools and weapons as a shaping and finishing process appeared for the first time during the Neolithic Period; but this by no means superseded the processes of shaping and finishing by means of chipping. Both persisted even after the use of metals had gained the ascendancy.

**The Bronze Age.** It is fortunate for man's happiness that he does not miss that of which he is ignorant. He lived in at least a fair degree of contentment on this earth for a million years, more or less, before he conceived the idea of making use of metals. It is not strange therefore to find that it took him a considerable length of time after he had discovered metals and how to make use of them before he discarded to any appreciable extent the implements and utensils of stone, which had meant so much to him up to that time.

Conservatism is deeply ingrained in man's make-up, especially in his prehistoric and primitive stages. He had, to be sure, experienced some revolutionary changes from time to time in his culture complex; but the core of the complex continued to be stone.

For the first time he was called upon to abandon the core and see his civilization crystallize about a new element, or rather group of elements, the metals. In the beginning, their properties defied his understanding: those of stone did not. Why give up a certainty for an uncertainty? Thus it was that man continued to lean heavily upon his stone age staff, while testing a new contrivance.

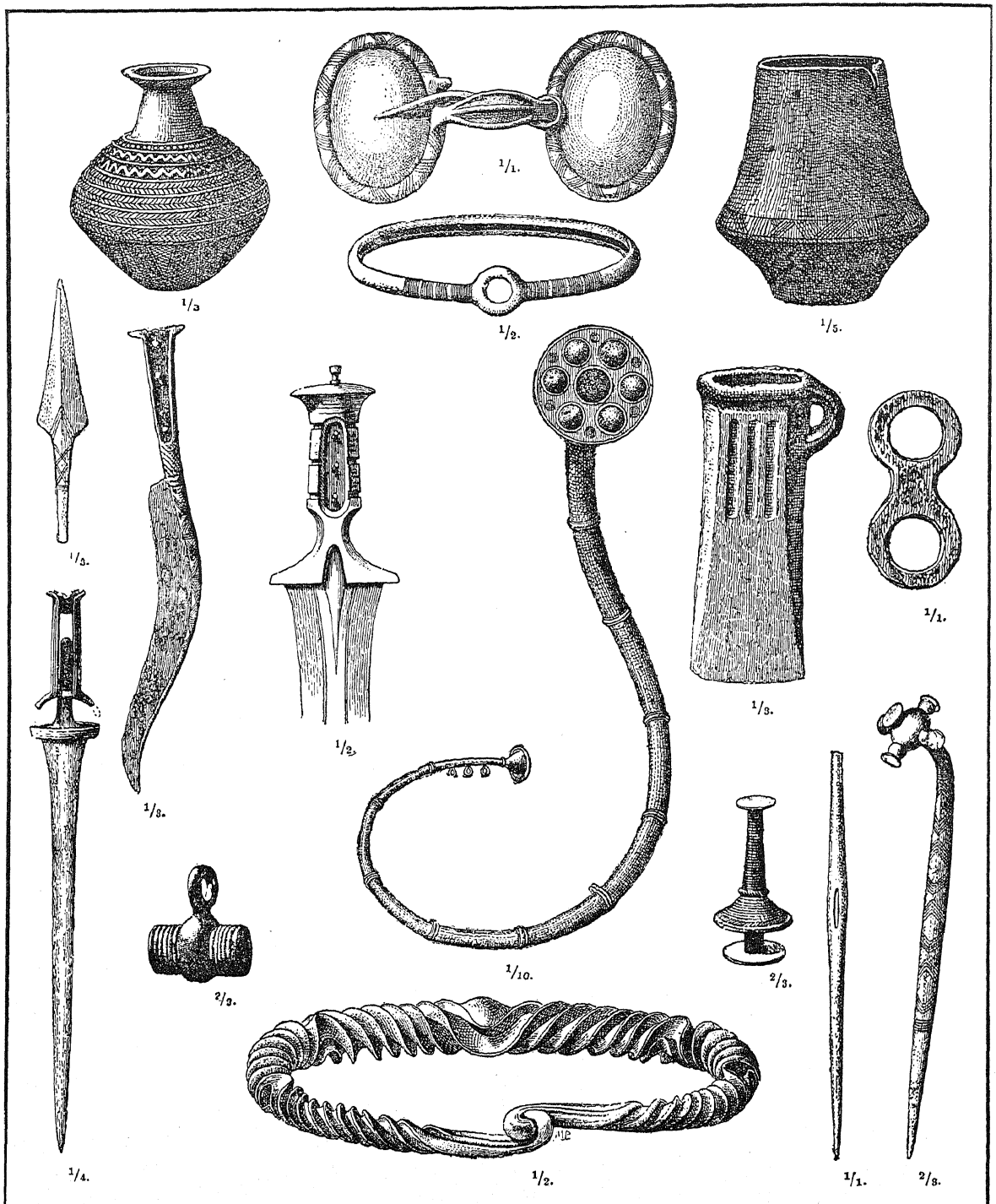
The change from the Stone Age to the Age of Metals was the most revolutionary step ever taken by man. It meant the discovery of a new world so far as cultural advancement was concerned. And yet for a considerable lapse of time it did not involve any very sweeping changes in man's mode of life. He did not abandon his stone tools and utensils, but he did not make any further distinct advances along that line. In regions where he had lived in pile villages, he continued so to live. Where he was in the habit of constructing dolmens and other megalithic monuments he did not suddenly abandon their construction. The potter's art which had been developed in the Neolithic Period continued to flourish, as did agriculture. The earlier modes of burial of the dead persisted with little change. Nevertheless, man had reached the parting of the ways and had wisely chosen the one which led to the dawn of history and to our time.

Copper was probably in use in Egypt as early as 5000 B.C. It was known in the Orient (Susa) about 4000 B.C. Bronze appeared in Egypt with the first dynasties but was rare prior to 3000 B.C. For a long period, copper and gold were the only metals employed. Most of these early metal objects were ornaments. Mines that were worked during this phase have been located in Sinai; the most noted of these is at Wady-Magarah. Copper mines of ancient date are also known in the Near East, including the Caucasus and Cyprus; Spain, and other parts of Europe. The idea of a transition age of copper was first developed in Ireland and Hungary, where objects of pure copper were found. Ireland is the richest of all countries in prehistoric objects of gold. The initial age of metals, known as the Chalcolithic, or Eneolithic, is well represented not only in Ireland and Hungary, but also in Bohemia, Saxony, Switzerland and southern France.

*Bronze-Age Chronology.* As early as 1859, Worsaae of Copenhagen subdivided the Bronze Age into two periods based on finds in England, Scandinavia and northern Germany: I. Early period during which inhumation was dominant, burial rites reminiscent of the Neolithic Period; II. Later period with incineration general.

Montelius of Stockholm later, 1885-95, made six divisions of the Bronze Age. Shetelig accepts the classification by Montelius and states that all six epochs are represented in Norway. In 1910, Déchelette adopted the classification of Montelius after reducing the number of epochs to four. The four epochs as accepted by Déchelette, and applicable to western Europe, are:



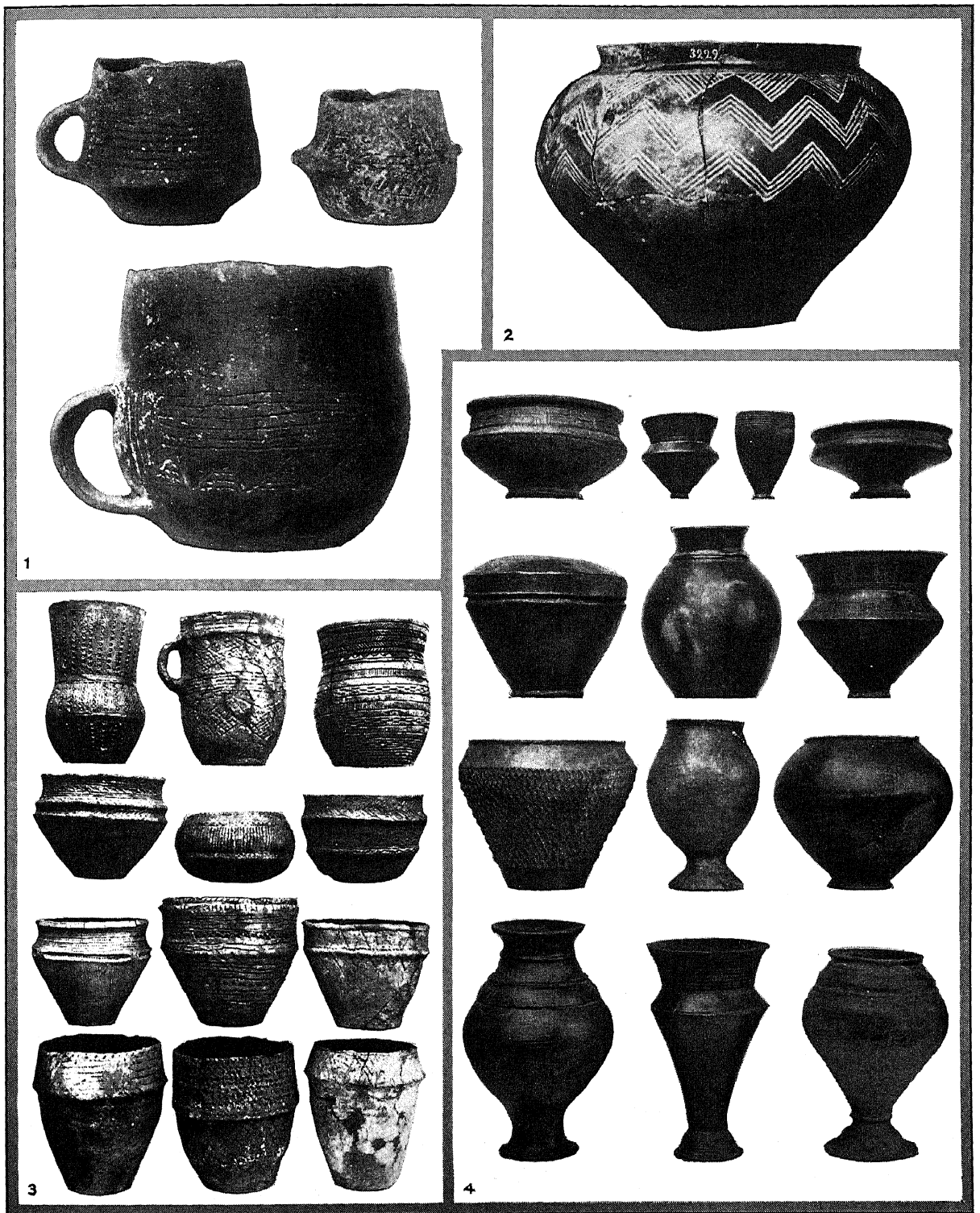


A COLLECTION OF BRONZE ORNAMENTS, TOOLS, WEAPONS AND MUSICAL INSTRUMENTS AND TWO CLAY VESSELS FROM DENMARK. BRONZE AGE

Epoch I, including the Chalcolithic, 2500-1900 B.C. Stone implements still much in use; tools and weapons of copper or of bronze containing but a small percentage of tin; flat axes; small triangular poniards with tongue or with rivets; poniards with

bronze handles (toward the end of the epoch); pins; lozenge shaped awls; glass tubes; beads of gold, bronze and altered turquoise (callais); crescents of gold; bell beaker pottery; inhumation sepultures; dolmens and tumuli rare.

# ARCHAEOLOGY



COURTESY GEORGE GRANT MACCURDY, YALE UNIVERSITY; 3, PHOTO FROM BRITISH MUSEUM

## POTTERY OF PREHISTORIC AGES

1. Pottery vessels from Kalbe, Saxony. Neolithic Period.
2. Pottery urn of the Hallstatt Epoch, early Iron Age, Switzerland.
3. Bronze Age sepulchral pottery, British Isles.
4. Pottery of La Tène Epoch, France. Late Iron Age.



Epoch II, 1900-1600 B.C. Bronze rich in tin; axes with plain borders only slightly elevated; triangular poniards with rounded riveted base; pins with spherical perforated heads; open bracelets with pointed ends; vases with two to four handles; sepulture same as in Epoch I.

Epoch III, 1600-1300 B.C. Axes with borders slightly raised above the level of each face; axes with transverse ridges or shoulders; axes with wings; long, slender poniards; knives with bronze handles; pins with wheel heads; ribbon bracelets terminating in volutes; pottery vases with deeply incised patterns; vases with nipple-shaped ornamentation; sepulture for the most part by inhumation.

Epoch IV, 1300-900 B.C. Axes with wings at the poll; axes with end sockets; swords with flat tongues, perforated for rivets, or with a longitudinal opening; swords with oval pommel; swords with antennae at the pommel, the swords being for the most part pistiliform; kidney-shaped bracelets, fibulae with simple and with crenelated arches; double razors; bridle bits; pottery vases of many types; incineration dominant.

**Iron Age.** The Iron Age seems to have had its beginning in the valleys of the Euphrates and Tigris at about the same time as in Egypt, about 1300-1200 B.C. The discovery of an enormous cache of iron was made prior to 1867 in the ruins of the palace of Khorsabad, near ancient Nineveh. This cache consisted for the most part of shuttle shaped ingots, each weighing between four and two kilograms (8.8 and 4.4 pounds). Each ingot was perforated near one end for suspension. According to Christopher Blinkenberg the extraction of iron from the ore began about 1300 B.C. on the southeastern shores of the Black Sea under the rule of the Hittite kings. Sir Flinders Petrie states that iron was in common use at Gerar, southern Palestine, as early as 1150 B.C. During the 19th Egyptian dynasty, 1250 B.C., Hall finds mention of iron in a religious text. Iron was known in Crete as early as 1100 B.C. In Greece the first epoch of the Iron Age corresponds with the Dipylon Epoch, 1200-800 B.C. The beginning of the Iron Age in Italy is placed at about 1000 B.C.

In Scandinavia Shetelig divides the Iron Age into two epochs. The first, called Pre-Roman, is characterized by the mediocrity of its civilization, also by the rarity of the objects found. The second, known as the Roman Epoch, covers the first four centuries A.D. During this epoch commerce by way of the North Sea played an important rôle. In central and western Europe, the Iron Age is divided into two epochs, known as *Hallstatt* and *La Tène*. The Hallstatt Epoch in France is synchronous with the late Celtic, the epoch of *La Tène* with Gaulois culture.

**Hallstatt Epoch.** Hallstatt culture in Europe is traceable over an extensive territory from Hungary to Spain and Portugal. The type station, the cemetery of Hallstatt, is situated in the Austrian Salzkammergut, near important prehistoric salt mines. It was discovered in 1846. During the next 20 years, 993 sepultures were uncovered. Of these 525 were in-

humations, 455 complete incinerations, and 13 partial incinerations. Hoernes states that incineration was dominant at the beginning but that inhumation led at the close of the epoch.

For the most part skeletons have an east-west orientation and lie either on the back or side. Grave goods from Hallstatt include a large and varied assortment. Unfortunately, very little attention was given to the pottery, especially by the earlier investigators. Objects of bronze outnumber those of iron. Amber was plentiful. Specimens of glass and gold were also found. According to Hoernes, the Hallstatt cemetery represents two phases: Phase I, c. 900-700 B.C. Ceramic urns with flaring rim, swords of bronze and iron, bronze razors, Italian vases of beaten bronze. Phase II, c. 700-500 B.C. Ceramic urns with bulging outlines, black figured Attic vases of the 6th century B.C., bronze anklets and bracelets, belts of beaten bronze with stamped ornamentation, bronze earrings, fibulae and pins of bronze, iron swords and poniards with antennae. In Germany and Switzerland the Hallstatt Epoch has been divided into four phases.

Hallstatt tumuli may be divided into two categories, those in which the central sepulture is at the original level of the ground and those in which it occupies a pit excavated beneath the original ground level. The tumuli are for the most part oval, or circular, with a depression at the center. The highest are not more than five or six meters in elevation and the diameter rarely exceeds 30 meters. Chariot burials first appeared during the second phase of the Hallstatt Epoch and persisted during the Epoch of *La Tène*. The chariots were light and luxurious and were generally four-wheeled. Forged iron covered hubs and even spokes.

Among Hallstatt weapons there are three types of sword: an early type of bronze not unlike those belonging to Bronze Age IV; a long heavy copy in iron of the bronze sword; a short sword of iron with the pommel terminating in two horns or antennae. The scabbard is usually of wood or leather, rarely of beaten bronze. The Hallstatt dagger with antennae is more varied than the sword; the iron blade is pointed and generally ribbed, the handle of bronze or iron, terminating in antennae. During the second Hallstatt phase metal sheaths were the rule for daggers; at first bronze, later iron. The bow and arrow were not much in use during Hallstatt times. Helmet and shield, if they existed at all, were made of perishable material. The knives were of iron and included for the first time those with articulating blades, a form which persists to-day in the ordinary pocket knife.

Buckets of bronze were of two types, one cylindrical, the other bulging in outline. Both were made by riveting together pieces of sheet bronze. The term *situla* is applied to the vessel with bulging outline. Some are plain, others are decorated. Glass vases first appeared in central Europe during the second Hallstatt phase. Cauldrons of bronze usually supported by tripods were in general use especially

in Greece and Italy. Bronze cups and bowls were more numerous than they were during the Bronze Age.

Although the potter's wheel was not yet known in central and western Europe, handmade pottery reflected a considerable degree of skill on the part of the potter. Some of the pottery was reserved for funerary purposes and some for common use. That for common use was made of black, brown or reddish paste, rather fine in texture, but friable and not well baked. Most of the common ware is perfectly plain. Cinerary urns were often tastefully decorated. The classic meander motive appeared in Europe during the Hallstatt Epoch, and with the beginning of this epoch painted pottery first appeared in Germany. Most of the painted vases are covered by a yellow slip on which geometric figures in black, or red and black, are painted.

Dress and ornament in Hallstatt times were marked by simplicity. Bronze bracelets with iron inlay date from the first phase. Hallstattians were the first to enamel their bronze. Belts and bracelets were much in vogue among the women during the second phase. The belts were generally of ample breadth. Leather belts with trappings of stamped metal were highly prized. Fibulae of the first phase were nearly always of bronze, those with unilateral spring being the oldest; following these came the type with bilateral spring, also without spring and with or without serpentiform arch. The clasp varies in length and is sometimes provided with a terminal button. The use of gold was limited almost wholly to small articles such as bracelets, earrings and pendants. Amber occurred in more than 300 sepultures at Hallstatt. It came from the Baltic and was supposed to have medicinal as well as talismanic power. In this class belonged coral. Throughout the Iron Age symbols connected with sun worship were employed as decorative features on articles of apparel and adornment. These include the crescent, horse, swan, sun's disk, etc. The golden ritual bowl found near Zurich is ornamented with such symbols.

**Epoch of La Tène.** Cultural epochs like individuals must have a name. The two epochs of the Iron Age were christened Hallstatt and La Tène respectively by H. Hillebrand at the Stockholm International Congress in 1874. Later, 1885, O. Tischler divided the Epoch of La Tène into three phases and these were christened by S. Reinach as follows: La Tène I, 500-300 B.C.; La Tène II, 300-100 B.C.; La Tène III, 100 B.C.-1 A.D. The type station, La Tène, meaning shallow, is at the northeastern end of Lake Neuchâtel and on the south bank of the river Thielle. When excavations were begun there in 1858 by Col. Schwab the site was completely covered by the waters of the lake. Later important engineering works resulted in lowering the water level of the lake some two meters, and bringing the site above water level. This facilitated enormously the work of excavation. Emile Vouga soon discovered substructures of numerous buildings and of two bridges across the Thielle

which drains Lake Neuchâtel. Paul Vouga has continued the work in recent years. The principal collections from La Tène are now in the Musée Historique at Neuchâtel and include many weapons both offensive and defensive. The prevalence of these weapons, the absence of evidence suggesting a place of manufacture, the absence of female apparel and objects pertaining to family life, leads Vouga to the conclusion that La Tène was a fortified emporium occupied by the military. The type station represents La Tène II in point of time and not the whole of the epoch.

Each of the three phases of La Tène culture corresponds to a well-defined evolution of two characteristic objects, the sword and the fibula, or safety-pin. During La Tène I, the swords were short with tapering point, feminine apparel rich, fibulae with arch recurved at the free end, bronze bracelets of many types, torques, ornaments of gold and of bronze. The swords of La Tène II were long with slightly rounded point. The fibulae have a recurved arch with the end no longer free but attached to the bow. The bracelets were of glass, those of metal becoming rare. The swords of La Tène III were extremely long with rounded point. As for fibulae, the recurved caudal appendage is completely fused with the arch.

The lance and javelin were companion pieces to the sword throughout the Epoch of La Tène. The dagger was derived from the Hallstatt dagger with antennae. A curious transformation of the dagger hilt took place toward the close of La Tène times. The lump between the antennae was converted into a human head, thus making arms of the antennae and body and legs of the rest of the hilt. The dagger with human effigy hilt occurs in the British Isles as well as in France, Italy and Switzerland.

Defensive armor was rare during the Epoch of La Tène, the shield being the chief exception. In some cases at least the shields were made of wood with a metal umbone. In 1910 Vouga discovered a wooden shield at La Tène in association with the skeleton of a warrior and the remains of his chariot, including a wooden yoke, also a spear and a sword. The ellipsoidal type of shield persisted in La Tène III, while the semicylindrical type disappeared. The shield of enameled bronze found in the Thames at Battersea, London, in 1855 is a work of art. Its ornamentation includes 27 buttons of red enamel. Much stress was laid by La Tène warriors on military insignia. The wheel and the wild boar were favorite symbols. The wild boar is found on a frieze at Narbonne, bas-reliefs at Orange, and the shield found in Witham River; it also surmounts the warrior helmets on the vase of Gundestrup (Denmark).

Among tools the iron ax played an important rôle. The iron ax with socket paralleling the blade made its appearance during the Epoch of La Tène. Winged axes, of iron, and axes with end sockets similar to those of the Bronze Age and Hallstatt Epoch continued in use. The big iron knife with but a single edge served as a weapon as well as a tool. In the

necropolis of Chalons-sur-Marne a knife was buried with every man, woman and child. A drawing knife of the type still in use among coopers dates from La Tène III. An inventory of the objects from a foundry site of La Tène III in Hungary included a pair of forceps. The first compasses date from the Epoch of La Tène.

As means of accumulating wealth developed facilities for protecting it were found in the shape of locks and keys. The iron key was in common use throughout La Tène III. Of the three types, the simplest is a bent bar of iron, the so-called temple key; another type is in the form of the letter T; still another is a bent bar of iron provided with a variable number of teeth near the end opposite the handle. Andirons of iron appeared sporadically during the Hallstatt Epoch, were rare during La Tène I and II, and were rather widely used during La Tène III. Pokers, pothangers, spits, cauldrons and large cauldron forks completed the inventory of hearth utensils.

The plow, scythe, sickle and a species of hooked knife were among the more important agricultural implements. During La Tène times the handmill with circular rotating milling stone first came into use. The introduction of the potter's wheel, unknown north of the Alps prior to La Tène I, marked a distinct step in advance. Pottery forms were many with decoration largely geometric. The designs were both incised and painted; plastic decoration was sometimes used, a good example being the so-called face urns.

The prototypes of the coins employed in western Europe during the Epoch of La Tène came from centers of Greek culture. According to Déchelette, gods are seldom represented on Gallic coins. The Gauls of southern France took for models the coins struck at Rome. A well-known series is the Cavalryman. On one series the lion is figured, on another the bull. Friend states that coins were introduced into Britain from Gaul about 200 B.C.; but even as late as Caesar's visit to the British Isles, iron bars were still used as currency in the interior just as they were used in certain parts of Africa up to the outbreak of the World War in 1914. The bars closely resemble unfinished sword blades with blunt, rectangular edges. They often occur as hoards or caches; at Meon Hill in Gloucestershire, 394 bars were unearthed from the British camp in 1824 and many other caches have been reported. The bars are not uniform in size or weight, the weights of the larger bars being simple multiples of the weights of the smaller bars.

According to Diodorus of Sicily the Gauls wore a tunic and trousers, also a cloak or mantle. Many-colored garments were the rule, the richer ones being brocaded or embroidered in gold. Greek artists represented barbaric warriors as going to combat nude except for the mantle. The principal elements entering into articles of adornment were bronze, coral and red enamel. Men wore belts, bracelets, rings and torques. Women also wore belts, bracelets, rings and torques, to which were added earrings and pendants.

The fibula, usually of bronze or iron, was very much in vogue. The arch pin and spring were all one piece. The spring was always bilateral. In the first phase the foot or recurved appendage extending beyond the clasp was developed sufficiently to touch the arch; with the second phase it not only touched but was actually fastened to the arch by means of a ring; during the third phase appendage and arch were completely fused.

The torque is seen on Gallic coins on which busts of warriors are represented. The warrior's belt of leather or cloth was fastened by a bronze clasp. A distinguishing character of La Tène belt buckles is that they were always of cast instead of hammered bronze. A chain belt of cast bronze was worn by women during the second phase. The chain belt was provided with an attractive pendant. Nearly all the bracelets were of bronze and they were especially esteemed by the women of La Tène I and II. Both bracelets and torques were sometimes ornamented with red enamel. Bracelets of iron, gold, silver, lignite, schist, jet and glass were rare. Some glass bracelets were colored yellow by means of sulphur, others dark blue by means of cobalt.

As for toilet articles, razors of bronze were displaced by those of iron. The association of razor with sword proves that La Tène warriors shaved part of their beard at least. The Gauls are said to have worn long drooping mustaches and to have shaved their cheeks. There were tweezers for pulling hair and curettes for ears and nails. Women had already learned the use of paints and pomades. According to Pliny, soap was invented by the shiny haired Gauls. The Gauls knew the value of manures; they fertilized their lands by means of lime and marl; they also made a wine of barley. Gallic dress about 300 B.C. consisted of trousers, a smock held in at the waist by a belt, and a sagum or cloak often provided with a hood. The Gauls seem to have been a mixture of the Celts from across the Rhine and the Ligurians from northern Italy.

Scissors came into use for the first time during the Epoch of La Tène. They consisted of a bar of iron terminating at each end in a blade and bent in such a way as to bring the edges of the two blades together and hold them in position under pressure, the prototype of the sheep shears still in use. The scarcity of combs in sepultures during the Iron Age is accounted for by assuming that wood was largely used in their manufacture. Most of the combs that have been preserved had but a single row of teeth. The pile village of Glastonbury has yielded a fine series of weaver's combs made of horn and bone. Although the mirror was known in Egypt and Greece as early as the Bronze Age, it seems to have been but little used in central and western Europe prior to the third phase of La Tène.

The art and religion of La Tène are reflected in the many and varied amulets. Teeth of the wild boar were much prized pendants. Both wheels and rings abounded during La Tène III, serving not only



as amulets but also as media of exchange. One of the tombs at Varilles (Marne) yielded a necklace composed of 100 coral beads, one amber bead, one clay spindle whorl, one shell, a piece of human bone, and a tooth of the wild boar. The animals most favored for amulets were the wild boar, horse, ox and ram. Entire figures of man and animals as well as parts thereof were employed as amulets. The crescent, swastika and triskele were important symbols. To the number three there seems to have been attributed a magic quality. Beads and rings by threes are found suspended from torques. A tendency to repeat the same motive three times is to be noted, for example in the triskele and the triple perforation of cranial amulets.

Inhumation under tumuli continued in La Tène I and II, especially where Hallstatt culture had taken root. Chiefs and noted warriors were interred with their chariots; this was especially true of La Tène I. Tumuli were soon superseded by flat inhumation tombs and later by incineration tombs. Flat inhumation tombs of La Tène II were not so rich as those of the preceding phase. It was no longer the fashion to bury chariots with the chiefs. Incineration tombs of La Tène III are poorer in grave goods than those where inhumation was practiced, and the objects are often injured by fire.

The center of La Tène culture was the region bounded by the Rhine and the Danube on the east and the Seine and Saone on the west. The numerous necropoli testify to a relatively dense population; some of these contain from a hundred to a thousand sepultures.

G. G. MACC.

See George Grant MacCurdy, *Human Origins: A Manual of Prehistory*, 1924.

#### PREHISTORY OF AMERICA

When Columbus discovered America he found it already inhabited by perhaps 50,000,000 human beings. While no precise date can yet be given for the first peopling of the New World the range between the earliest possible and the latest possible dates has been greatly reduced in recent years. It is now very generally admitted: 1st, that the Red Man entered America by way of the Siberia-Alaska "bridge;" 2nd, that physically he is most closely allied to the tribes of northeastern Asia; 3rd, that culturally he brought with him the simple arts of the Age of Polished Stone, without domesticated plants but probably with the dog as a self-tamed companion.

Although diligent search has been made for evidence of man in the New World before or during the last Ice Age no convincing proofs have come to light either as regards art in stone of a true Palaeolithic type or skeletal remains of human beings on a lower plane of development than that of modern man. The single tooth on which a primitive man, called *Hesperopithecus*, was constructed is now admitted to be the tooth of a peccary instead of an anthropoid. The greatest possible age of man in America is therefore somewhat less than the lowest limit of the Age of

Polished Stone in the Old World: somewhat less because time must be allowed for this complex of tools, utensils, etc., to reach the northeastern parts of Asia before it could possibly flow over into America.

**Migrations from Siberia and Alaska.** The Behring Strait route from Asia to America is not one that would attract heavy migration even under more favorable conditions than now obtain. Recent studies of the thin layers of clay left annually by retreating ice sheets show climatic conditions were once more favorable to man than they are at present. But if one goes back too far they become less favorable and even impossible.

Perhaps it would be safe to say that migrations into America via Siberia and Alaska began about 8,000 to 12,000 years ago and continued for a long time. Peoples of one general physical type and one general culture but of many languages dribbled into America, spreading out and possessing themselves of the new land until the ultimate regions of Cape Horn were reached. They surely had stone celts, fire-making apparatus, bows and arrows, carrying bags, baskets, and in all probability myths, dances and medicine men. The American Indian has retained this Neolithic culture in the marginal areas of the New World, including the western and northern part of North America and the southern and eastern tips of South America. In other parts of the New World the Indian had raised himself to an agricultural level by the domestication of plants unknown in the Old World and in a few regions had reached the heights of civilization.

Among all the nomadic non-agricultural tribes ordinary history is practically non-existent. Occasionally pictographic records may cover events of several generations. The shell heaps and other archaeological deposits of these peoples generally show very little change or advance in the arts of life. Here and there an exception must be noted, as along the Northwest Coast where abundant fish food and sedentary life lead to the development of interesting arts. Alaskan totem poles are family trees containing the same kind of history one finds on heraldic shields. A kind of impersonal history of ancient contacts can sometimes be deduced from the diffusion of certain ideas expressed in crafts, in mythology and in social usage. When, for instance, two Indian tribes at a distance from each other speak the same language we must imagine that once they lived together.

**Beginnings of Agriculture.** Somewhere in the central portion of the New World agriculture was invented, probably in a region where maize grew wild. Archaeology shows that this was probably the highlands of Mexico and Central America. The arts of life of the first American farmers form what is known as the Archaic culture. With maize, beans, squashes, etc. for food the Indian became sedentary with leisure for practicing textile and ceramic arts. The first distribution of domesticated food plants from the region of origin was into other arid environments reaching south from Mexico into the western parts of

South America and north into the so-called Pueblo region of New Mexico and Arizona. Again actual dates are wanting; but the beginnings of agriculture in America may go back 5,000 years. The long duration of the Archaic culture is evidenced in Mexico and Central America by deep deposits of pottery. Small clay figurines of men and women, the latter apparently fetishes of fertility, mark the routes by which maize spread far and wide during a first arid land distribution.

Dry land farming with irrigation was followed after a long period by wet land farming with new plants brought under cultivation, such as cacao, sweet potatoes and manioc. Here the Mayas seem to have led; but important contributions are ascribed to the Amazon valley. The total series of plants brought under cultivation by the American Indians included maize, beans, cotton, tobacco, squashes, tomatoes, potatoes, peppers, peanuts, cacao, pineapples and about 60 other items. In the present economy of the United States these plants make up more than half of our total agricultural wealth.

A typical archaeological section of ancient American history is seen in our southwestern states where the aridity aids in preserving vestiges of the past. There was first in very ancient times a nomadic culture known as Basketmaker I, a phase of the widespread Neolithic culture already discussed. Then in Basketmaker II a small flint corn came into use, probably introduced from Mexico. Basketmaker III followed with the first crude pottery and the first crude slab houses, circular and partly subterranean. Great skill was shown at this time in weaving sandals, and in other forms of textile art.

In Pueblo I culture level, which followed Basketmaker III, the head form of the people changed, perhaps as a result of new diet. Other plants such as beans, squashes and cotton appeared, and there were also some little female fetishes which recall those of the Archaic culture in Mexico. The houses were still made of slab rock set on edge to form walls which were doubtless roofed over with perishable materials. On the Pueblo II culture level small farming communities with rectangular houses of stone and adobe were widely distributed, the sites being marked by black and white pottery, coiled pottery, etc.

Pueblo III culture prevailed from about 800 up to 1275. Now the village area was restricted, perhaps as a result of raiding nomads, and the large community houses and cliff dwellings were often constructed with an eye to defense. A new territorial extension was made to the southward. Soon there was trade with the Toltecs of Mexico, parrot feathers and copper bells being brought north to exchange for turquoise. This period of Southwest history, as we know from the Douglass calendar of tree rings, was terminated by a long drought. Pueblo IV culture is distinguished by a pottery in which glazed paint was employed, and runs from 1275 to the great rebellion against the Spaniards in 1680. In 1538 Coronado had entered with his adventurers, and by the end of that

century white settlements were flourishing. Pueblo V culture carries Pueblo life up to the present time.

**Measurement of Time.** The only important time scale in ancient America is supplied by the famous day-count of the Maya Indians which began to function on Aug. 6, 613 B.C. according to the Spinden correlation. It has recently been shown by Ludendorff that the peculiar permutation around which this day-count is constructed was arrived at by the analysis of intervals between eclipses and that astronomical observations of the Mayas began as early as 750 B.C. Dates in this Maya system are inscribed on monuments after about 100 B.C., permitting us to arrange the sequences in sculpture, architecture, etc., in intervals of years or even of days. The names of individuals and places cannot yet be deciphered in Maya inscriptions. We have some very brief digests of their history which reach back to 176 A.D.

The First Empire, so-called, extended up to 630. Many splendid cities of stone were constructed; but as yet no metals were in use. The period ended with a mysterious abandonment of all the older Maya cities. New settlements were soon formed in the central part of Yucatan in a restricted area. Then about 960 the Second Empire got under way in northern Yucatan with Chichen Itza as the capital.

**Rise and Fall of Toltecs.** In 911 Chichen Itza was captured by the Toltecs who in the two centuries previous had built up a widespread domain on the highlands of Mexico. These Toltecs really owed their start to influences emanating from the First Empire of the Mayas. Their great success in conquest is explained by the circumstance that a series of fairly high civilizations then stretched from northern Mexico to Peru, these being of an unmilitary type. The nearest approach in America to the typical predatory civilizations of Europe and the Near East is seen in the Toltec domain built up by Huetzin, Ihiutimalli and Quetzalcoatl. By this time metals had come up from South America, and the Toltecs demanded gold, silver and copper as tribute. Their trade extended from northern New Mexico to southern Colombia, and their administered empire seems to have covered most of Mexico and Central America.

It is possible to show that ideas developed in certain military cults of these Toltecs having to do with warriors who dressed to represent eagles and jaguars and who used "lightning serpents" as weapons streamed northward into the Pueblo and Mound areas and southward to Peru. Some of the ideas were modified in diffusion. Humanized eagles holding the severed heads of enemies are found in mounds of the Mississippi, apparently giving rise to the Thunderbird who hurls the "lightning serpent" among modern Indian tribes from the Great Lakes to Behring Strait.

After the fall of the Toltecs in 1220, which resulted in the abandonment of their fine capital at Teotihuacan with its enormous pyramids of the Sun and Moon, there was a slow up-building of other powers. The Aztecs reached the shores of Lake Tezcoco in 1325 and in 1351 they won a battle for the king of

Colhuacan which resulted in their being given two small islands. Upon these they established Tenochtitlan as their capital. Their first ruler with kingly authority was Acamapichtli, elected to the throne in 1376. Under Itzcoatl and other great kings the Aztec power widened rapidly and if it had not been interrupted by the arrival of Cortes with steel, gunpowder, smallpox and other lethal weapons the Aztecs might have registered even wider gains than the Toltecs.

The archaeology of Peru might be compared with that of the Southwest, because stratified remains again become important. The ancient Peruvians were the world's finest weavers, and the pottery and other art coming from Peruvian graves furnishes much more complex problems for the archaeologist than the comparatively simple remains of the Pueblos. There is evidence in Peru of a primitive culture at the bottom, then a fine classical civilization, various periods of which were dominated by Chimu, Paracas, Nasca and Ica on the coast and by Chavin and Tiahuanaco on the highlands. After this came the conquering Inca civilization. An empire grew up rapidly under several Inca rulers whose approximate dates are furnished by tradition.

H. J. Sp.

See H. J. Spinden, *Ancient Civilization of Mexico and Central America*, 1922.



ARCHÆOPTERYX

*The oldest known avian type*

**ARCHÆOPTERYX**, the most ancient of known fossil birds. A true bird, the size of a pigeon, it retained many reptilian characteristics, such as the beakless, toothed jaw, and the extraordinary vertebrated tail, longer than the rest of the body.

The finding first of a single feather, then of fairly complete remains in Jurassic beds near Solenhofen,

Bavaria, created a scientific sensation in 1860-62. The fine lithographic limestone preserved impressions of wing, tail, and leg-feathers. The body may have been covered with perishable down. The wings are short, with three free, clawed, grasping fingers. The tail was not fanshaped, like a modern bird's; the feathers branched from the vertebrae like leaflets along a midrib. In the absence of strong breast-muscles necessary for sustained flight, these long and broad tails, together with the quilled leg-feathers, may have been useful for volplaning. Single specimens are exhibited by the Berlin and British museums.

**ARCHANGEL**, an important port and city situated on the Gulf of Archangel on the coast of the Northern Region of the R.S.F.S.R. On the Dwina River, about 40 mi. from the White Sea, Archangel is Russia's greatest center of timber export, and possesses a large harbor generally open from May to September. In 1553 the English explorer Richard Chancellor landed near Archangel seeking a route to the East, and established trade relations between Muscovy and England. Archangel was founded in 1584 to facilitate this commerce. The port carried on the entire Russian foreign trade until the rise of St. Petersburg, now LENINGRAD, in the 18th century challenged its supremacy. Shipping gradually transferred to the Baltic, until in 1865 Archangel was abolished as a port. But with the opening of a railroad in 1897 the city grew steadily and it recaptured much of its former prestige, in 1931 receiving 82% of the White Sea traffic. The city derives its name from the imposing 18th century monastery of Michael the Archangel. The Northern Regional Museum, a large library and a polytechnical college are important institutions. Although the timber trade leads all others, there is considerable traffic in furs, fish, tar and other commodities. The port is 20 mi. in length and the depth of the water is 23-25 ft. Pop. 1926, 69,578.

**ARCHBALD**, a borough in Lackawanna Co., northeastern Pennsylvania, situated on the Lackawanna River, 10 mi. northeast of Scranton, in an anthracite coal region. Archbald is served by three railroads. The chief interest is mining; there are, however, silk and children's clothing mills. The "Pot-hole," a glacial formation 20 ft. in diameter, is an interesting landmark of the city. Archbald's incorporation date was 1877. Pop. 1920, 8,603; 1930, 9,587.

**ARCHBISHOP**, a bishop who, in addition to exercising authority over his own diocese, presides as metropolitan over the bishops of a province. See CANTERBURY; YORK; ARMAGH.

**ARCH BRIDGES** are built of most structural materials. Steel and reinforced concrete are much used though plain CONCRETE and stone are often employed since a well designed arch develops very low tensile stresses in the "arch ring." If steel or reinforced concrete is used, the arch may be partly above and partly below the traffic deck; in a span of plain concrete or stone, the traffic deck must rest on the top of the arch. If bedrock is available as abutments, steel spans of 300

ft. or more are generally employed, though monumental bridges of moderate span are frequently constructed of stone, concrete, or reinforced concrete. *See also* BRIDGES.

**ARCHDEACON**, from an early period the name which has been applied to a deacon, later a priest, who assists the bishop in supervising clergy, in the upkeep of the fabrics of churches, parsonages and the like.

**ARCHDIOCESE**, the district in which an archbishop resides and exercises all his episcopal functions, whether or not he has jurisdiction over SUFFRAGANS. An archbishop who has no suffragans is not a METROPOLITAN, but governs his own archdiocese only. He is also called "titular," but is not to be confused with the TITULAR BISHOPS and archbishops whose titles derive from obsolete sees. There are 29 archbishops without suffragans in the Catholic Church, who rule only their archdioceses.

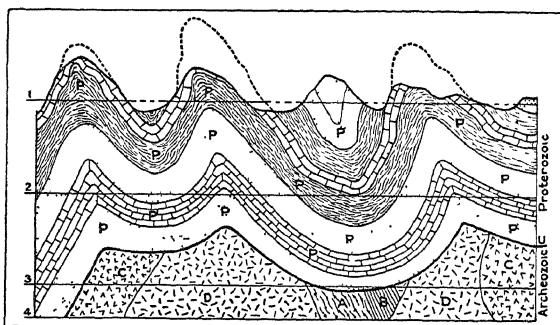
**ARCHELAUS**, a son of HEROD THE GREAT by his Samaritan wife, Malthake, inherited Judea as his kingdom. His reputation was so evil that JOSEPH, returning from Egypt with the infant Jesus (*see* JESUS CHRIST), thought it prudent to turn aside and settle in Galilee. As a result of complaints against his tyranny, Archelaus was banished to Vienne where, apparently, he died.

**ARCHEOZOIC ERA**, the first era in the geological history of the earth, stretching back to the time when the earth had assumed practically its present form, and the processes of WEATHERING, EROSION, SEDIMENTATION, crustal deformation and VULCANISM had begun to mould and modify the surface features of the globe. According to the planetesimal hypothesis of Chamberlin and Moulton, the planets of the sun formed from solid particles, or planetesimals, which had cooled and solidified from gaseous material shot from the sun by tidal disruption, on the near approach of another star. Thus an always solid, slowly growing earth is postulated. According to Harold Jeffrey's tidal-disruption theory, however, the gaseous material gathered into planets *before* solidifying, so that the earth was first gaseous, then liquid, and finally solid. Geological history would thus begin with the formation of a crust on the cooling globe. Whichever picture may be the true one, the fact remains that the oldest rocks have never been recognized, the earliest known formations being sedimentary and volcanic, laid down on some preexisting floor still too deeply buried to be seen. Long ages of subsequent geological processes have so metamorphosed and contorted those earliest sediments and lavas that often their original nature is hardly decipherable.

Although these rocks underlie many areas now covered by later formations, there are few places where they can conveniently be studied. The best locality is the great shield-shaped area surrounding Hudson's Bay and extending into the United States in the Great Lakes region, known as the Pre-Cambrian shield, since the Archeozoic and PROTEROZOIC eras are together called the pre-Cambrian. The oldest rocks

known there are GNEISSES, metamorphosed from coarse sediments, known as the Couchiching Series, which are 20,000 to 30,000 feet thick. A later outpouring of lavas in tremendous quantity now form the metamorphosed Keewatin schists. In a few places great thicknesses of LIMESTONE were also deposited, a part of the Grenville series of sediments.

This era was one of dominant igneous activity, shown by the thick succession of lava beds, and the intrusive masses of GRANITE which invade the rocks in many places. These intrusions accompanied the thrusting up of a great mountain range north of the present St. Lawrence Valley and parallel to it. With the forming of mountains and elevation of the land, erosion and weathering became dominant, until the whole continent was reduced to a flat plain, or pene-



FROM CHARLES SCHUCHERT, OUTLINES OF HISTORICAL GEOLOGY, JOHN WILEY & SONS

GENERALIZED DIAGRAM TO SHOW EXTENT TO WHICH THE CANADIAN SHIELD HAS BEEN DENUDED OF ITS PRE-CAMBRIAN ROCKS

A, Keewatin; B, Couchiching; C and D, Laurentian-Algonian granites. Below are the folded Archeozoic formations that were eroded to a flat peneplain (U) and then deeply covered by horizontal Proterozoic strata (P). Subsequently the whole series of rocks are again folded into mountains, causing the peneplain U to be highly deformed, as shown

Lines 1 to 3 represent successive levels of erosion, the distance down to line 3 being 6 mi. or more. The original surface of the Proterozoic mountains, above line 1, is to be compared with young, unworn mountains like the Coast Ranges. When erosion has planed down to line 2, a stage is reached comparable to that of the Appalachians, which are worn to their roots. Line 3 represents the present surface of the Shield

plain. Upon this the rocks of the next era, the Proterozoic, were deposited from new seas again flooding the land.

Estimates based on the radioactive content of Archeozoic IGNEOUS ROCKS indicate that this oldest era occupied about 30% of all recorded geological time, and dates back to 1,200 million years ago. Life probably began then, a belief indicated in the name Archeozoic, meaning "archaic life." Formations like fossil algae are found, but are open to doubt; the occurrence of limestone and GRAPHITE, however, which are usually of organic origin, indirectly point to the existence of life at that time. Since fossils are few, these guides in classifying and correlating strata must be replaced by the less sure criteria of similarity in nature, occurrence and succession of the beds examined.

Archeozoic rocks are found in the Appalachian and Rocky mountains, the Grand Canyon, and in Brazil,

Scandinavia, India, Africa and China. *See also* LAVA; ROCK; CAMBRIAN; GEOLOGY; GEOPHYSICS; PALEOZOIC; PALEONTOLOGY; EVOLUTION; PETROLOGY; SCHIST.

S. F. K.

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**ARCHER, WILLIAM** (1856-1924), British drama critic, was born at Perth, Scotland, Sept. 23, 1856. He received his master's degree from Edinburgh University, and in 1883 became a barrister of the Middle Temple. After travels in Australia, he returned to London to become associated with several newspapers as dramatic critic, the *Figaro*, *World*, *Tribune*, *Nation* and the *Star*. Archer was a champion of the "new drama" exemplified by Ibsen, and while on the *Figaro* translated *Pillars of Society* for production. He introduced the great Norwegian dramatist to the English-speaking world by his translations and by his editing of the collected works of Ibsen in 11 volumes. Archer wrote a number of books on the stage and several plays, among them *The Green Goddess* in which GEORGE ARLISS made his celebrated success. He died at London, Dec. 27, 1924.

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**ARCHERY**, shooting with bow and arrow or with crossbow and bolts. The latter is obsolete; but some savages still depend largely on the bow in hunting. The discovery of the bow predates the Stone Age, arrows with pointed tips of charred wood having undoubtedly been used before arrowheads of chipped



COURTESY BRITISH MUSEUM

ASSYRIAN ARCHERS ATTACKING A CITY

stone. Ishmael "became an archer," the Old Testament states; and for centuries the Egyptians were famous mounted archers. Babylonians, Persians and Scythians were adepts, Scythian archers guarding some of the later Roman Emperors. The Greeks and Romans largely used mercenary archers from various Eastern nations.

While the English of the Middle Ages were the greatest archers of all time, contemporary Egyptians and Turks were almost their equals, as the Crusaders discovered. The English long bowmen became especially famous. They bore bows the height of their bodies, averaging around six feet, or several inches longer than the bows of Eastern archers. A Welsh archer once shot through an oak door four inches thick. For years after the battles of Crecy and Poitiers, won largely by long bowmen, every able-bodied Englishman was required to master the national weapon.

Since 1905, archery has been revived as a sport. The modern bow pulls from 40 to 60 pounds for men, 24 to 32 for women. Yew is still considered the best wood, although lemonwood, cedar and hickory are used. The standard target is four feet in diameter, made of coiled straw ropes, and painted in concentric circles  $4\frac{1}{2}$  inches wide. The white outer ring counts 1 point; the next, black, counts 3; then blue, counting 5; red, 7, and the inner circle of gold, 9. The usual distances for men are 60-80 and 100 yards; for women 50 and 60. York or St. George's Rounds are special contests.

*See* Maurice Thompson, *The Witchery of Archery*, 1878; T. Waring, *A Treatise on Archery*, 1828.

**ARCHIL**, a purple dye obtained from various lichens chiefly belonging to the genus *Rocella*. These are often called orchella weed or dyer's moss, and are found principally on the west coast of Africa. The dye, not originally present in the lichens, is developed by heating with ammonia a paste composed of the ground plants and water. One modification of the process produces French purple or lime lake, a more brilliant and lasting dye; another gives litmus, a blue dye used by chemists as an indicator. Archil is sold as a liquid, a paste or a powder. It is a satisfactory dye for marble and was formerly used for coloring wool.

**ARCHILOCHUS** (7th century B.C.), Greek lyric poet, was born on the island of Paros in the 7th century B.C. He moved to Thasos, but was unfortunate there and next settled in Sparta. The Spartans considered his writings licentious and banished him. From Sparata he went to Siris, but finally returned to Paros, where he was killed in a battle with the Naxians. Archilochus invented the epode and perfected iambic trimeter and trochaic tetrameter. He wrote elegies and hymns and his satiric poems were very popular. HORACE, in his early work, imitated Archilochus.

**ARCHIMANDRITE**, the title given in the Greek Church to the superior of several monasteries or of some important one. An archimandrite may confer minor orders upon those subject to him. As the title is also an honorary one, there are both regular and secular archimandrites.

**ARCHIMEDES** (c. 287-212 B.C.), famous mathematician of Sicily, a friend and perhaps a kinsman of Hieron and Gelon, kings of Syracuse in that island. He studied at Alexandria, and thus came in contact with the work of Eratosthenes and his slightly older contemporary Aristarchus of Samos, of whom Archimedes has recorded that he taught that the earth revolves round the sun, and that the apparent diameter of sun and moon alike is half a degree. Besides writing a series of mathematical works on the sphere and cylinder, on conic sections, on the measurement of circles, on the center of gravity of planes, in all of which he worked out geometrical methods of proof, he is famous for his solution of the problem of Hieron's crown, in which silver was mixed with gold. Archimedes while in his bath noticed that

his stretched out legs lost weight in the water. Experiment showed him that the weight lost was equal to the weight of the water displaced. A body which lost all its weight had exactly the same weight, or the same specific gravity, as the water it displaced. In this way he found the specific gravity of the crown and was thus able to tell how much gold and silver it contained. It is said that he was so pleased with his discovery that he leaped from the bath and paraded the street exclaiming "Eureka! I have found it!" He also experimented with screws, levers and mirrors arranged to produce the effect of burning glasses. He is said to have raised a ship with a lever and to have offered to raise the earth; if a fulcrum were given him. He was put to death by an ignorant soldier when the Romans captured Syracuse in 212, though the Roman general had given express orders that he should be saved.

**ARCHIMEDES, SCREW OF**, a pump which elevates water by the action of a rotating helix. There are three different types. One comprises a cylinder enclosing a helix to which it is attached so that both rotate; in another, the helix rotates within a stationary cylinder; and a third consists of a cylinder wound helically around a central axis. Similar machines are employed in elevating grain. The device is said to have been invented by ARCHIMEDES.

**ARCHIMEDES' PRINCIPLE.** See AEROSTATICS.

**ARCHIPELAGO**, the original name of the Aegean Sea, lying between Greece and Asia Minor, and later given to the islands in this area; applied in modern usage to any group or cluster of islands. The name is not found in early or medieval Greek, and most etymologists trace its present form to the word *Arche*, meaning "sea of the kingdom," which was in common use at the time of the Latin empire. In its strictest sense, archipelago means a sea, or a broad body of water surrounding islands or groups of islands. In the Aegean Archipelago, there are two groups of islands, the Cyclades, from *kyklos*, a circle, which lie nearest the coast of Europe, and the Sporades, or "scattered," which occur on the Asiatic side. The Malay Archipelago, in the Indian Ocean, is a graphic illustration of the use of the word in its present-day sense.

**ARCHITECTURAL EDUCATION.** Architecture, like the other arts and skilled trades, has until relatively modern times, been taught entirely by the apprentice system. The *ECOLE DES BEAUX-ARTS*, Paris, was founded in 1648, but it was not until the 19th century that it became the model for similar schools all over the world. About the middle of the 19th century, American architectural students began to study at Paris, and the next half century saw the establishment of many architectural schools in the United States, the first being the Massachusetts Institute of Technology founded by William R. Ware in the early '70s. These schools, numbering in 1932 more than 50, were usually at first modeled after the *Ecole des Beaux-Arts*; but the present tendency is towards a growing freedom from French influence,

and an increasing recognition that American schools must be more closely in touch with their American environment. The French terminology is still extensively used. In 1916 a group of American architects, graduates of the *Ecole des Beaux-Arts*, established in New York the *BEAUX-ARTS INSTITUTE OF DESIGN*. The institute issues throughout the year architectural problems simultaneously to many schools throughout the country; after the specified period, the solutions are sent to the institute and there judged competitively. The *Beaux-Arts Institute of Design* offers annually a Paris Prize, the winner being sent to Paris to study at the *Ecole des Beaux-Arts*. The American Academy at Rome offers a similar prize for three years' study in Rome.

The curriculum of the usual three- or four-year course in the American architectural school includes drawing of all kinds, the theory and history of architecture, graphics, engineering and construction; about half the total time is spent in the solution of problems in design. After much experimentation, the greater number of schools have decided that owing to the broad scope of the subject, it is impossible for any school to graduate finished architects, or even expert draftsmen; the aim is therefore generally to achieve a curriculum that shall train the 3-dimensional imagination, stimulate the power of analysis and design, and furnish a broad and deep foundation in other subjects for later development. Many schools require at least two years of non-professional college work for entrance. After graduation, the young architect customarily enters the office of an established architect and works there for several years, before entering into practice for himself.

**ARCHITECTURAL SOCIETIES.** The growth of the profession of architecture during the 19th and 20th centuries has been accompanied by the formation of professional associations all over the world. These exist for the protection alike of the public interest and the professional status of the architect. In general they not only watch over general matters affecting architecture, such as housing standards, building regulations, great public improvements and the like, but also direct legislation of architectural interest, such as the licensing or registering of architects to protect the community from the incompetent.

The chief national architectural societies are: UNITED STATES, *American Institute of Architects*, founded 1857. AUSTRIA AND HUNGARY, *Akademischer Architektenverein a.d. Techn. Hochschule; Architektenklub der Genossenschaft der bildenden Künstler Wiens; Reichsverband der Baumeister Oesterreichs*. BELGIUM, *The National Society of Architects of Belgium*, founded 1872; *The National Society of the Town Planners of Belgium*. BRAZIL, *Associacao Brasileira de Architectos*. BULGARIA, *La Société des Ingénieurs et Architectes Bulgares*. CHILE, *Sociedad Nacional de Arquitectos*. COLOMBIA, *La Sociedad Colombiana de Ingenieros*. COSTA RICA, *Facultad de Ingenieria*. CZECHOSLOVAKIA, *National Society of Czechoslovak Architects; Czechoslovak Society of*



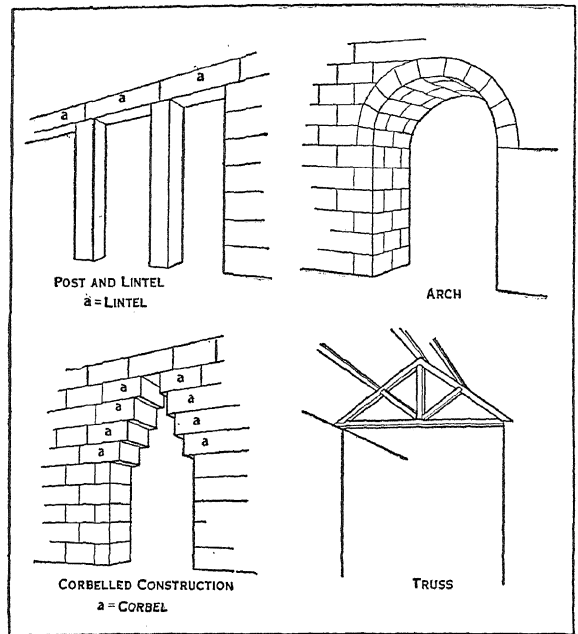
*Town Planning.* ECUADOR, *Asociacion Politecnica del Ecuador*. EGYPT, *The National Society of Architects of Egypt*. FINLAND, *Finnish Architectural League; Architectural Guild*. FRANCE, *Chambre Syndicale des Architectes Français; Société des Architectes diplômés par le Gouvernement*, founded 1877; *Société Centrale des Architectes; Fédération des Sociétés d'architectes Français*. GERMANY, *Bund Deutscher Architekten; Verband Deutscher Architekten und Ingenieurverein*. GREAT BRITAIN, *The Royal Institute of British Architects*, founded 1835. ITALY, *Associazione Nazionale degli Ingegneri ed Architetti Italiani*. JAPAN, *The National Society of Architects*. LATVIA, *Architektu Biedriba*. LITHUANIA, *The National Architectural Society of Lithuania; The National Society of Town Planners of Lithuania*. MEXICO, *Sociedad de Arquitectos Mexicanos*. NETHERLANDS, *Bond van Nederlandsche Architecten*. NORWAY, *Kristiania Arkitektforening; Norsk Byplanforbund*. POLAND, *Stowarzyszenie Techników w Warszawie; Déléation des Architectes Polonais*. PORTUGAL, *Associacao dos Architectos Portugueses*. ROUMANIA, *Societatea Arhitecților Romani*. SPAIN, *Sociedad Central de Arquitectos; L'Associacion de Arquitectos de Cataluna*. SWEDEN, *Svenska Teknologforeningen; Kommunaltekniska Foreningen*. SWITZERLAND, *Bund Schweizerischer Architekten; Schweizerische Vereinigung für Heimatschutz*. URUGUAY, *Sociedad de Arquitectos; The National Society of Landscape Architects, of Uruguay*. VENEZUELA, *Colegio de Ingenieros de Venezuela; Compania de Urbanizacion del Este, Esquina de "El Conde"*. DENMARK, *Akademisk Arkitektforening* (Institution of Danish Academic Architects); *Dansk Arkitektforening* (Danish Town Planning Laboratory); *Dansk Anlaegsgartner-og Haverarkitektforening* (Danish Landscape-Architects Association).

**ARCHITECTURE**, a synthesis of the art and the science necessary in creating beautiful buildings. Its essence is therefore double, comprising both the aesthetic design necessary to produce beauty, and the technical knowledge required to realize it in actual buildings. The science of structure is, by itself, engineering, and becomes architecture only when the purely artistic element of beauty enters in. Similarly, the conception of a beautiful building becomes architecture only when it is embodied in actual material.

Just as the architect uses engineering without being pure engineer, so he may use ornament without becoming pure decorator. Contrary to a general misconception architecture never consists in the mere application of ornament or decoration to structure. The architect uses ornament for many reasons: to emphasize certain points in the design, to give character to a building, to create the correct scale, that is, secure the right relation of dimensions in all the parts, so that the whole structure shall appear its true size, or merely to give the whole a vital, human touch. But in architecture the decoration is always subservient.

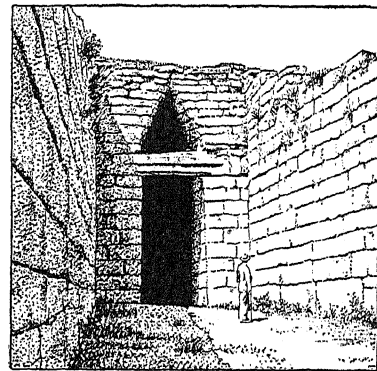
**The Architectural Alphabet.** The forms which the architect uses for the creation of beautiful build-

ings are necessarily those implicit in the idea of building itself. It is with walls, roofs, windows, doors, floors, ceilings, and wall treatments that his effects are produced, exactly as a painter uses colors, or a musician tones. Naturally every change in these factors, or im-



DIAGRAMS OF TYPES OF CONSTRUCTION

provement in the method of their construction, will change the architect's conceptions. For instance, plate glass has revolutionized shop design, and steel windows have given the architect a whole new category of forms.

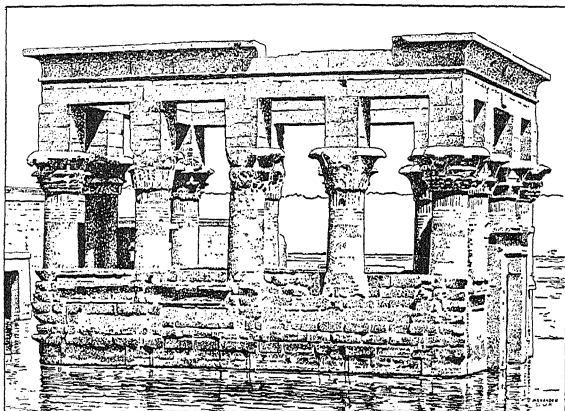


FROM ORIENT AND OCCIDENT PHOTO

TYPES OF CONSTRUCTION: CORBELLED  
Tomb of Agamemnon, also known as the  
Treasury of Atreus, at Mycenae, Greece

Three main systems of supporting loads over empty spaces have vitally affected architectural design. The first, most primitive and simple, is known as post and lintel construction, in which two upright supports carry a horizontal beam, or lintel, big enough to bridge the gap between them. STONEHENGE is an example of Neolithic post and lintel construction, and the same

system determined the forms and effects of EGYPTIAN ARCHITECTURE and GREEK ARCHITECTURE as well as most of the Chinese and Japanese work. (See CHINESE AND JAPANESE ARCHITECTURE.) At times pure post and lintel work is combined with a certain amount of cantilevering or corbelling: that is, the use of hori-



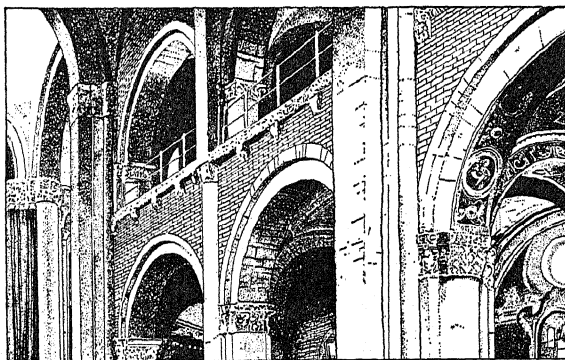
FROM PHOTO BY EWING GALLOWAY, N.Y.

**TYPES OF CONSTRUCTION: POST AND LINTEL**

*"Pharaoh's Bed," one of the ruined temples on the island of Philae, in the Nile, Egypt*

zontal beams so arranged, braced and counterweighted as to carry weights on projecting, unsupported ends. In this way many primitive pseudo vaults were produced, many early tombs being roofed by horizontal courses of stone, each one of which projects slightly inward beyond the course below it.

The second great principle is that of the ARCH and VAULT, according to which spaces were roofed over by means of a series of radiating, wedge-shaped units, and so arranged that no one can move without the displacement of all. This system opened the way for



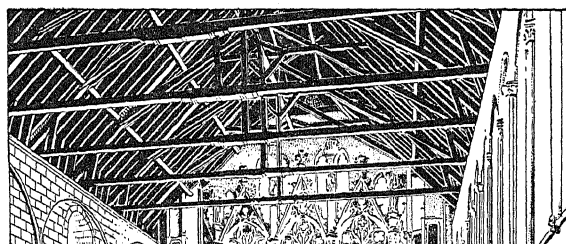
**TYPES OF CONSTRUCTION: ARCHED**

*View in the basilica of San Michele, Pavia, Italy*

large unencumbered interiors, and its use dominates much of Roman architecture and the greater portion of Byzantine, Romanesque, Gothic, and Mohammedan work (see BYZANTINE ARCHITECTURE; ROMANESQUE ARCHITECTURE; ROMAN ARCHITECTURE; GOTHIC ARCHITECTURE; MOHAMMEDAN ARCHITECTURE) as well as a great deal of Renaissance work. (See RENAISSANCE ARCHITECTURE.)

The third system is the truss, in which members of varying lengths are framed together to form rigid triangles, and all the stresses in the members, tensile or compressive, work together to give theoretical equilibrium. This system also allows large interiors, and its forms have vitally affected some Medieval and Renaissance work, and many modern buildings.

The actual materials with which buildings are built are also important in determining architectural forms; each new material is a new architectural opportunity. If we consider post and lintel construction, we will find how different materials can completely change the type of architectural effect produced. In Egyptian temples where stone furnished the beams as well as the posts, columns or supporting walls, the result was small dark rooms, or large halls crowded with columns, and an atmosphere of heaviness, mystery and gloom. Where wood is used for beams, the resulting architectural forms are more light, airy and open. Columns may be more slender, as the weight supported is less; and supports farther apart, since wood in a beam is relatively stronger for its weight than stone. The slender columns, widely spaced, of the



**TYPES OF CONSTRUCTION: TRUSSED FORM**

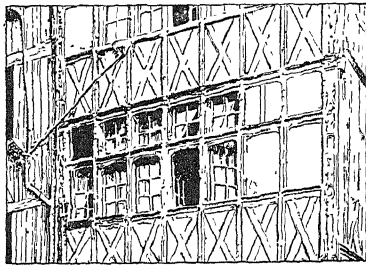
*From the Hall of the Palais de Justice at Rouen, France*

ancient Persian palace halls, the comparative openness of Greek temple interiors, and the airy interiors of Chinese temple halls, where wood was usually used for supports as well as beams, show the effect of the material.

In the last hundred years metallic beams and supports, first of iron, then of steel, have come into wide use and another architectural revolution has occurred. It is still the old system of post and lintel construction, but the great strength of steel allows unheard of widths of span and great delicacy of supporting members. Little by little it has become necessary, as heights of buildings increased with the development of the elevator, to carry on the steel columns or posts not only the floors and roofs, but the enclosing walls, as well. Experience has shown that in the great heat of a large fire, unprotected steel is almost as perishable as wood; it will not burn, but it will twist and wave and so destroy the structure. Thus it is necessary to cover all the steel of a building with a protective coating of masonry.

The materials used for the arch and vault also gave rise to new architectural forms. The crude brick vaults of the early Tigris-Euphrates valley made long, narrow halls and arched gateways possible. But it

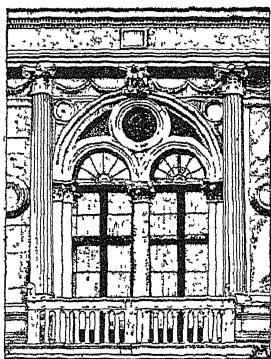
took the carefully cut stone vaults of Etruria and the early Roman empire to give freedom and flexibility of design, and the Roman concrete vaults made possible for the first time tremendous open interiors without intermediate supports. In the 12th and 13th centuries cut stone vaults again determined the architectural forms. The rise and perfection of Gothic Architecture were largely the result of the structural requirements



EFFECT OF MATERIALS ON DESIGN:  
WOODEN WINDOWS AND HALF-TIMBER  
WORK  
*House of the Annunciation, Rouen, France*

inherent in the problem of the creation of stone vaulted churches that should be light and beautiful.

The materials used modify not only the forms which structural methods produce, but all other forms as well. The shapes and sizes of doors, windows and roofs, and the types of wall treatment vary according to the possibility of the stone, brick, wood or metal with which they are built. Even purely decorative



EFFECT OF MATERIALS ON DESIGN: THE MASONRY WINDOW OPENING  
*Palazzo Vendramini, Venice*

forms are similarly sensitive to material and technique. A leaf, for instance, in cast bronze will be treated entirely different from one carved in granite.

**Architecture and Life.** Architecture impinges upon ordinary life more constantly and closely than any of the other arts. Its creations determine a great part of the average individual's physical environment. With the growth of the urban population, architecture is continually more and more important, for a

large part of the city's subtle effects upon consciousness are due to the character of the buildings in which the citizen lives, works, plays or worships. The very constancy with which architecture is before him has created in him a certain obtuseness to it; yet its effect, depressing or exhilarating, good or bad, goes on being felt, though little appreciated or understood.

The architect, moreover, is trained to a comprehensive, inclusive attitude. Though economic forces at the present time have forced him to design a city in little isolated buildings on isolated lots, his conception of a city is larger than that fact would indicate. To

the ideal architect, the problems of the city as a whole must be intensely evident. Air, light, sanitation, circulation of vehicles or pedestrians, and the combination of all of these with a controlling desire to make each practical problem an opportunity to create new beauty are basically architectural problems. TOWN PLANNING is merely the application of the architectural mind to the designing not of a single building, but of a whole community.

The architect is ever on the lookout for ways in which the physical environment of each of us may



COURTESY ALBERT KAHN, ESQ., DETROIT, MICH.

EFFECT OF MATERIALS ON DESIGN:  
STEEL WINDOWS IN STEEL CONSTRUCTION

*Building of the Murray Corp., Detroit, Michigan. Albert Kahn, Architect*

more completely fill our needs. Architects have usually been leaders in the enactment of building codes, in the development of housing standards and in the beautification of cities. Thus architecture is important in its relation to civic, economic and social problems, as well as in the actual buildings created. In other words the architectural mind is necessary to the civic health.

The intimate connection between architecture and life is obvious in the exactitude with which architecture has expressed the life of past times. From a study of the buildings of any nation or period, a

trained mind can deduce a thousand details of culture, economic, state and even political make-up characteristic of the structures' builders. Thus the discovery and excavation of Pompeii have thrown floods of light on the life of the early Roman Empire; and the Walls of Carcassonne, Chartres Cathedral and the Chateau of Coucy are almost equally revealing with regard to the life of medieval France. Future generations will find in the buildings of to-day the same indications of the life we are living.

**Appreciation of Architecture.** The enjoyment of architecture is open to all. Yet that particular awareness of enjoyment that is the basis of sound appreciation usually comes only with a distinct effort to keep the mind open to the architectural impressions it receives, to dwell on them and savor them. The quality of the appreciation, moreover, can be raised by a training in discrimination and sensitive attention, and a study of at least the main trends of architectural development.

Some basis of knowledge of critical theories with regard to architectural aesthetics will markedly increase the power of discrimination, if only by stimulating the emotional response to architecture by appropriate accompanying intellectual exercise. What qualities should a building possess in order to be good architecture? All systems of architectural criticism, from Ruskin's romanticism expressed in *The Seven Lamps of Architecture* to Le Corbusier's social functionalism as expressed in *Towards a New Architecture*, are merely attempts to answer that question.

Certain qualities necessary to architecture are so generally accepted that they may be stated without fear. These are the general rules of aesthetics which apply to any art: unity, variety, harmony, proportion, rhythm, balance and, possibly, climax. Buildings, by their very nature, have variety of form; length, breadth and thickness are qualities of any object in three dimensions. Moreover, buildings, save in such great monuments as the pyramids, have the additional complexities that their functions and materials make necessary. It may be safely assumed that almost the first duty of the architect is to create a unity out of this variety, a whole which shall appear one just as definitely as it is one thing. Every part must be so designed as to exist not by and for itself, but so as to help the general unity of composition.

Parts must be harmonious, as well. All the portions of the composition should create unity as different notes produce a chord, by being instinct with some harmony of feeling or form. There are myriads of ways of producing harmony. There is harmony of shapes, as in a building whose windows are all the same shape and size; harmony of detail, such as that where windows of different sizes are made harmonious by surrounding them with a similar frame, and harmony of spirit or character. Yet however produced, the harmony must be felt in the separate parts, and in the relation of the parts to the whole.

Aesthetic proportion is merely the quality that results from a proper relationship of sizes. Many

attempts have been made to find arithmetic or geometric rules for beautiful relationships, but the matter seems more complex than any method yet devised. The eye picks out equalities in sizes easily when the sizes run the same way; but equalities of breadth and height, for instance, are difficult even for the trained eye to perceive. And if equality, the simplest possible relation, is at times difficult to grasp, how much more difficult to think that the eye is always looking for related diagonals, and the  $\sqrt{5}$ ! Yet it is undeniably true that to the majority of people over many eras certain relationships, or groups of relationships, appear pleasant and others chaotic and unpleasant. In the one case we say the object is in good proportion, in the other, that it is without proportion. In general it is sufficient to realize the general cause of certain individual reactions to buildings, and to examine them carefully in search of allied or harmonious or pleasant size relationships.

Rhythm is a matter of repetition, of measures. Any repeated motive like a window or an ornament creates a rhythm; but in buildings there are rhythms more subtle than that. Rhythm in architecture can mean repetition of differences, as well as repetitions of identity. For instance, if the stages of a tower vary so that the second is lower than the first, and the third than the second, and the differences are the same, or closely related, we feel a rhythmical variation. In any complex building there are many rhythms, horizontal and vertical, of things varying and things alike; yet all the building's rhythms, like those of an elaborate piece of musical counterpoint, must have a pleasant inter-relation.

Balance need not mean symmetry, though symmetry is the most obvious balance. The quality of architectural balance means that there is an expressed quietness and repose in the totality of a building; one part shall not seem to outweigh the whole unpleasantly. Picturesque unsymmetrical balance is achieved through so designing the whole structure that some center of interest is created close to or identical with a theoretical center of balance. This may be roughly found by a process analogous to balancing two unequal weights on a lever, in which case equilibrium results when the mass of one  $\times$  its distance from the fulcrum = the mass of the other  $\times$  its distance. In design, however, it is not a matter of mere mass or weight, but a summation of elements of which the mass is only one, and the amount of aesthetic interest of the parts, of attention-calling spots, for instance, another. There is balance of mass, balance of interest, balance of color; all are important; all are intimately related.

Climax is less universal. Indeed there are some buildings, like the Colosseum at Rome, for instance, where part of the beauty lies precisely in its lack of climax, in the regular march of the arches around the enormous ellipse. Perhaps the shape itself, with its regularity, is the climax. Nevertheless, climax is a distinct element in many buildings. In some the climax is an interior, a great room. In a ritualistic church the climax should be the altar or sanctuary.

The main entrance is frequently the climax of the front. The extreme of climax in a building gives it a dramatic quality; it creates a center of interest. In large buildings there may be several climaxes, all related, and all leading up to one which dominates all.

There are other requirements of a good building, more specifically architectural. The most important is the question of scale, that is, the quality of possessing the appearance of true size. A large building should appear large, a small building small. The problem of scale is largely the problem of relating the building to the human being. Steps, railings and doors have come to have so common a general size that their use in a building helps its scale, if they themselves are not over- or under-sized. When balustrades are made enormously overlarge, as in the façade of St. Peter's and other Italian Baroque buildings, the whole building is dwarfed thereby. The mind instinctively imagines these units of the usual size, and, grasping the relative proportion of the unit to the whole, imagines the whole structure smaller than it is. The reverse fault is equally unsatisfactory. Many small houses exist in which all the details fit only for a large mansion are used; their small scale gives them inevitably a toy-like, unreal appearance.

Besides the practical elements of steps and railings, decoration is also used to give scale. Sculpture, especially of the human figure, always has an easily grasped relation to the human size, and so sets a scale for the whole. In Egyptian temples, for instance, where the forms are large and simple, the surface decoration of tier on tier of carved and painted figures and hieroglyphs is necessary not only to give interest, but also to furnish an easily sensed measure by which the great size of the whole is instinctively felt. Any breaking up of the surface by carving or color has something of the same effect. The mind feels the scale of an area or line subdivided more easily than one that is entirely continuous.

Honesty in expression is another desirable quality in buildings. To a romantic critic, it is one of the major necessities, and much architectural controversy has arisen because of the use of the word. Honesty is usually considered an ethical, rather than an aesthetic quality, and any discussion of architecture from the ethical point of view, except perhaps in connection with its social responsibilities, is futile. The term honesty, in architectural criticism, means that a building shall express its materials, structure and function: that is, that its forms shall not contradict those matters, but shall flow naturally from them. Perception of this natural consistency between the forms and the structure or purpose of a building gives pleasure, and the lack of it produces strain; it gets between us and our enjoyment of the building's beauty. There is no ethical, esoteric element in this honesty at all; it is a purely aesthetic matter.

In the application of these principles of architectural criticism, three main differing attitudes have arisen, dependent on the varying emphasis given the different elements: classicism, romanticism and expres-

sionism or functionalism. Classicism places the emphasis on pure form and considers architectural beauty principally as a matter of the relationship of shapes. Classicism in this sense does not signify a use of Greek, Roman or Renaissance detail. It is not a matter of styles, but it does mean that a building, to be beautiful, should have the same devotion to pure proportional excellence, the same qualities of repose and dignity, and the careful arrangement of forms that characterized Greek architecture.

Romanticism in architecture lays stress on the emotional quality of a building, its power to arouse in the beholder definite emotional response. In one sense classic beauty is emotional, but the emotion aroused is of that undefinable type we call aesthetic. Romantic beauty, on the other hand, arouses definite, recognizable emotions, such as worship, awe, fear and gaiety. It is frequently associated with the medieval styles.

Functionalism differs from classicism and romanticism in that its approach to architecture is dominantly intellectual. For the functionalist, the merit of a building must be sought entirely in the perfection with which its shapes arise out of, first, the materials and method of construction, and, second, the work that the building does. Every building is considered as a machine, that is, a manufactured contrivance to do a certain job with the least expenditure of material and labor. The functionalist architect first must analyze the problem of what his building should do, and, second, conceive the most economical machine for accomplishing this. He must be ruthless in his attack on the problem, and prune his creation of any superfluities. Ornament is anathema to him. A machine architecture for a machine age is the functionalist watchword.

Every building may be criticised from each of these viewpoints. The greatest buildings, the works of that superabundance of creative energy we call genius, are often equally valid in all three categories. They have pure form, perfectly related; they arouse appropriate emotions in the beholder, and they are excellent machines for fulfilling their functions.

**The Dilemma of Modern Architecture.** The unprecedented swiftness of the mechanical and industrial development of life in this century has allowed little time for cultural adjustment. Moreover it has been accompanied by an equally intensive study of archaeology and the history of architecture, and the production of myriads of books on past architecture and the details of past styles. In a more real sense than ever before we are the heirs of all the ages; our culture is the development of past cultures. Yet never has there been such a radical change in living and working conditions as that which has characterized the last 50 years. The result has been a flood of new architectural problems, as office buildings, great hotels, apartment houses, movie theaters and factories, and a flood of new mechanical and engineering building methods to supply them, as steel skeleton construction, reinforced concrete and the thousand applications of electricity to elevators, ventilation and lighting.

There is an inevitable resulting chaos. Nostalgia for the past, the love of past times, costumes and artistic forms, is apparently a fundamental fact of human psychology, perhaps related to an atavistic ancestor worship. There are two Golden Ages, one in the future and one in the past. The occasional use of the forms of past styles fulfills, therefore, some deep need of the personality, and acts as well as a corrective to personal eccentricities. Yet any archaeological approach to architecture is utterly sterile, utterly sentimental; any beauty of a building which is simply a copy in conception or detail is solely the fleeting beauty of stage scenery. The archaeological architect denies another great need of the human mind, the need for creation.

It would seem then that any attempt to jettison the value of tradition in architecture was as doomed to sterility as any attempt to deny modern changes, modern problems and building materials. It is manifestly silly to attempt to force steel construction into forms for which it is not suited. It is also useless to claim that any form, because it has been used before, is therefore *per se* bad.

The problem of modern architecture can only be creatively answered by forgetting the style question entirely. Stylism, the use of a form in design because of a preconceived idea of style choice, is always deadening because it is a limitation of creative activity. And this is as true of modernistic stylism as it is of the preconceived choice of an ancient style. Modern architecture at its best and broadest will not be stylistic. It will achieve beauty through the freest, most natural creative handling of its problems and its materials. It will express the whole of life, not merely a portion, archaeological or modernistic. See ARCHITECTURE, HISTORY OF, and separate articles under individual headings.

T. F. H.

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**ARCHITECTURE, HISTORY OF**, furnishes a valuable commentary on the life and culture of the people who produced it; it is also an essential aid to the appreciation of architecture to-day. Yet before the history of architecture itself can be intelligently understood, it is necessary to know what influences determine the architectural works of any given place or period, and what forces produce changes in them.

Architecture has always been sensitive to two classes of influences, physical and cultural, or psychological. The most important of the physical elements that condition it are the available building materials, climate, and economic and political conditions. An

architecture of wood always differs essentially from an architecture of stone; the high roofed wooden churches of medieval Norway vary markedly from the stone vaulted churches of medieval France. So the availability of each material develops definite types of architectural forms. Climate is equally important. Deep snow gives rise to steep roofs; frost means deep foundations and the use of materials that freezing will not disintegrate. A sunny hot climate means thick walls, small windows, or by contrast where there is much breeze, large openings, and in some cases broad, overhanging eaves. Roofs of gentle slope, as for example, the classic Greek and Roman temple roofs, predominate in warm, dry climates, and steep roofs, like the high gables of a German town, are found in cold, wet countries. Economic and political conditions likewise influence architecture. An urban and a rural civilization will use distinctly different architectural forms. Thus, the great abbey groups of 12th century Europe and the castles of the same period and later, are largely the expression of a feudal civilization, and the closely crowded houses of Pompeii are equally the result of an individualistic urbanism.

The psychological elements that determine architectural forms are tradition, fashion and religion. Tradition is merely the custom of doing things in a certain way, because that is the way they have always been done. In a trade or art which is learned by its practitioners under a system of apprenticeship, the development of traditions is inevitable. Tradition, moreover, rests on two other foundations: one, the fact that the traditional method or form is the result of long evolution, and is the residue from many experiments, and, second, a sort of apotheosis of the past, perhaps allied with ancestor worship. Traditionalism is then in part a cult of the old. Fashion is equally a cult, but of the present, and the new. It is a result of the suggestibility, the herd mind, of the majority. Religion is even more important in determining architectural forms. Many of the world's greatest buildings have been of religious origin, such as temples, shrines, synagogues, mosques and churches. Religious ideas have also frequently conditioned decorative development. In early cultures especially, where magic and religion are closely related, the architectural use of symbols of magic or religious significance has been almost universal. Thus the Egyptian lotus was originally such a symbol; yet the lotus form through the modifications and descendants, the anthemion and palmette, has vitally affected architectural ornament ever since.

There are other important events or influences that produce architectural modification. For instance, growing trade skill, due to constant experimentation and the development of more efficient methods and tools, is a tremendous factor in architectural evolution. Thus the change from Romanesque architecture into Gothic was largely the result of improved methods of vault building, and the growing skill in the use of all sorts of metals is a controlling element in architectural creation to-day.



The impact of a different culture upon a people is another thing that produces architectural change. Trade, conquest and travel may all cause this impact. Thus the early trade throughout the Mediterranean broadcast Egyptian decorative forms and later those of Greece, and Greek decorative design shows the influence of the earlier dispersion, as the work of Etruria and Rome reveals the later. When the conquest of Greece by the Roman republic was complete, the foundations of Roman imperial architecture were laid, and the military adventuring of Louis XII, Charles VIII and Francis I in Italy paved the way for the French Renaissance. When it became the custom in the 17th century for the English to make the grand tour of France and Italy, then it became inevitable that classic, Palladian taste would dominate the English Renaissance. The well-nigh universal travel habits of Americans to-day necessarily affect in some measure their architecture.

Another trend affecting architectural development is the tendency, apparently universal, for forms developed from structural systems or technical processes to persist as purely decorative forms when the structural use has gone, or the technical process been changed. The Guttae, or little round forms on the bottom of the bracket-like mutules of the Doric order, are stone reminiscences of wooden pegs. And dentils, or projecting rectangular blocks in a row used as a decorative molding, are certainly the decorative development of forms which were originally the ends of wooden crossbeams. In the Medieval styles tracery underwent a similar development. At first, a structural element subdivided a large window into small spaces easy to glaze; it later became purely decorative and was used to ornament wall surfaces, crests and panels, without regard for its structural origin.

**Primitive Architecture.** All primitive architecture was the result of two needs, the need for shelter and the need to commemorate either the dead or the service of the gods. The need for shelter gave rise first to the use of caves and later of huts. The need for commemoration led to the development of tombs and temples. Then, as social life evolved, the need for a protection of a group instead of mere individual shelter produced the grouping of dwellings into villages and towns, and the erection of stockades, walls and fortifications. The exact methods by which the cave dwelling and the hut of roughly piled or tied saplings and branches grew into finished structures is difficult to reconstruct from the scattered remains. It is probable that the cave man began to pile rocks in front of the cave door as additional protection, and then, roofing the intermediate space with boughs and leaves or earth, achieved a covered room outside the cave proper. This led eventually to the construction of separate houses with masonry walls, and either thatched, sloping roofs or flat roofs covered with beaten earth or clay. Viollet-le-Duc, in the *Histoire de l'habitation humaine*, postulates such a development as the common heritage of the Aryan peoples. And the existence of such masonry built towns in natural

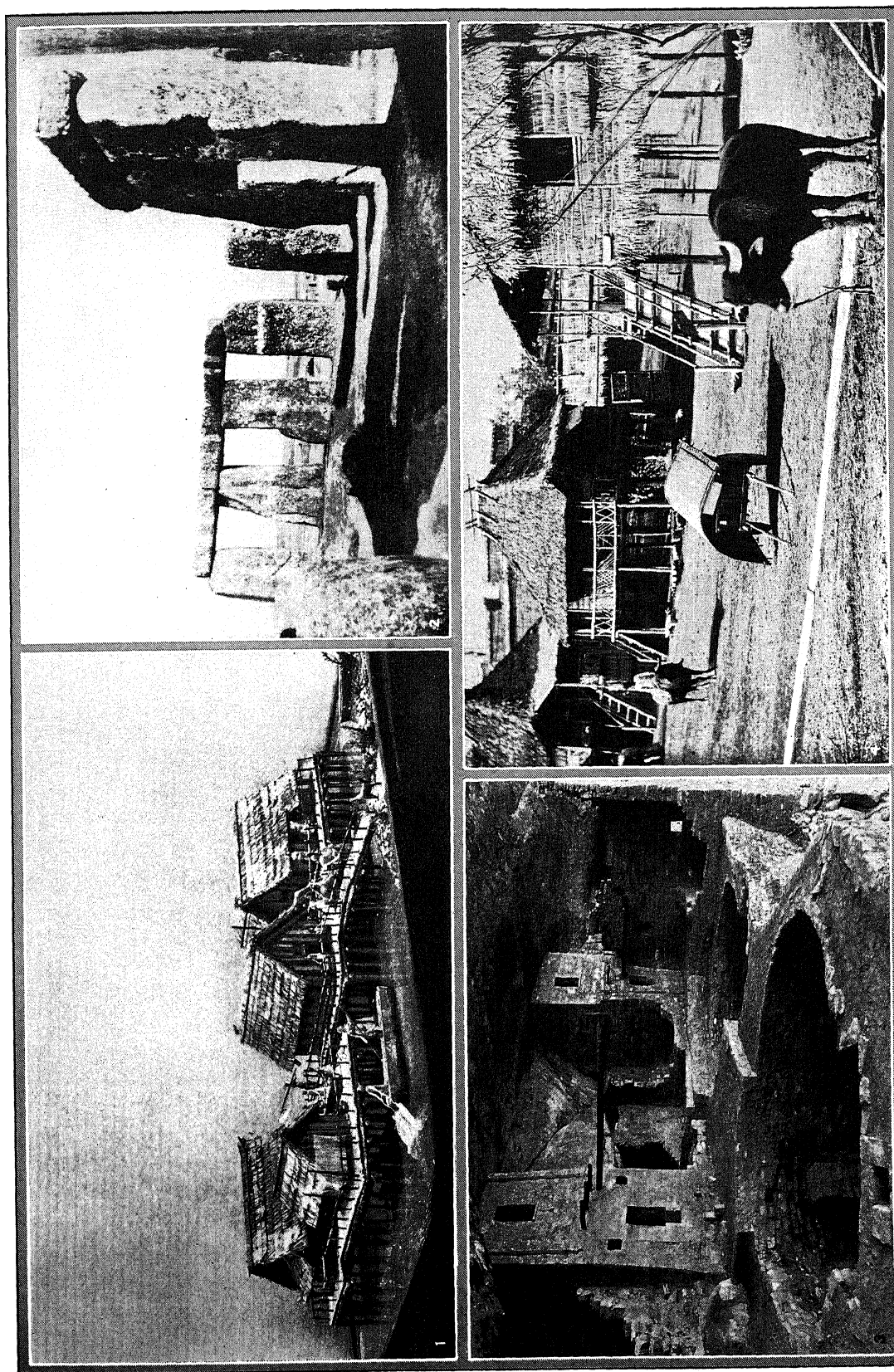
caves, such as that great group of pre-Pueblo ruins in the Mesa Verde National Park, U.S.A., gives evidence of a similar development in America. Another early descendant of the cave dwelling is the dugout or sod house, somewhat similar in general idea to those built in the early days of the white settlement of the plains of Kansas. These dugouts, half sunk into the ground, and half above it, not only were economical in material, but to prehistoric peoples undoubtedly gave a feeling of security based on the cave dwelling tradition.

Whatever the line of development, by Neolithic times (in Europe roughly 10,000-1500 B.C.) several methods of building had developed: the dugout, as seen in important remains near Skara Brae, Orkney, showing several houses, with elaborate built-in stone furniture, connected by a curved street perhaps also once underground; the round hut with or without a foundation or masonry; the rectangular house with a gable roof, as shown in early Italian funerary urns, and the framed timber rectangular houses of the LAKE DWELLERS.

In religious architecture, early man developed cave temples, like those in Malta, hill top shrines or "High Places," as well as those great spaces for ritual, surrounded with enormous stones of which Stonehenge is the most remarkable example. In the somewhat related funerary buildings, the most important type is the tumulus, or mound, piled over and around a stone-built chamber that held the body and the funerary offerings.

The extant monuments of this prehistoric art consist largely of caves, with or without painted decorations, both for residence and worship; hut circles or house foundations of stone, frequently of great complexity; representations of primitive houses in funerary urns; the many remains of lake villages; tumuli, and the megalithic monuments of great stones, known as *menhirs*, or isolated vertical stones usually marking burial chambers, and *dolmens*, or uprights carrying a cap stone, and such enormous groups as the great circle of STONEHENGE in England or the group at CARNAC in Brittany. These seem generally of religious or funerary origin; the dolmens or cromlechs seem to be the stone burial chambers of tumuli brought to light through the gradual washing away of the earth that once covered them.

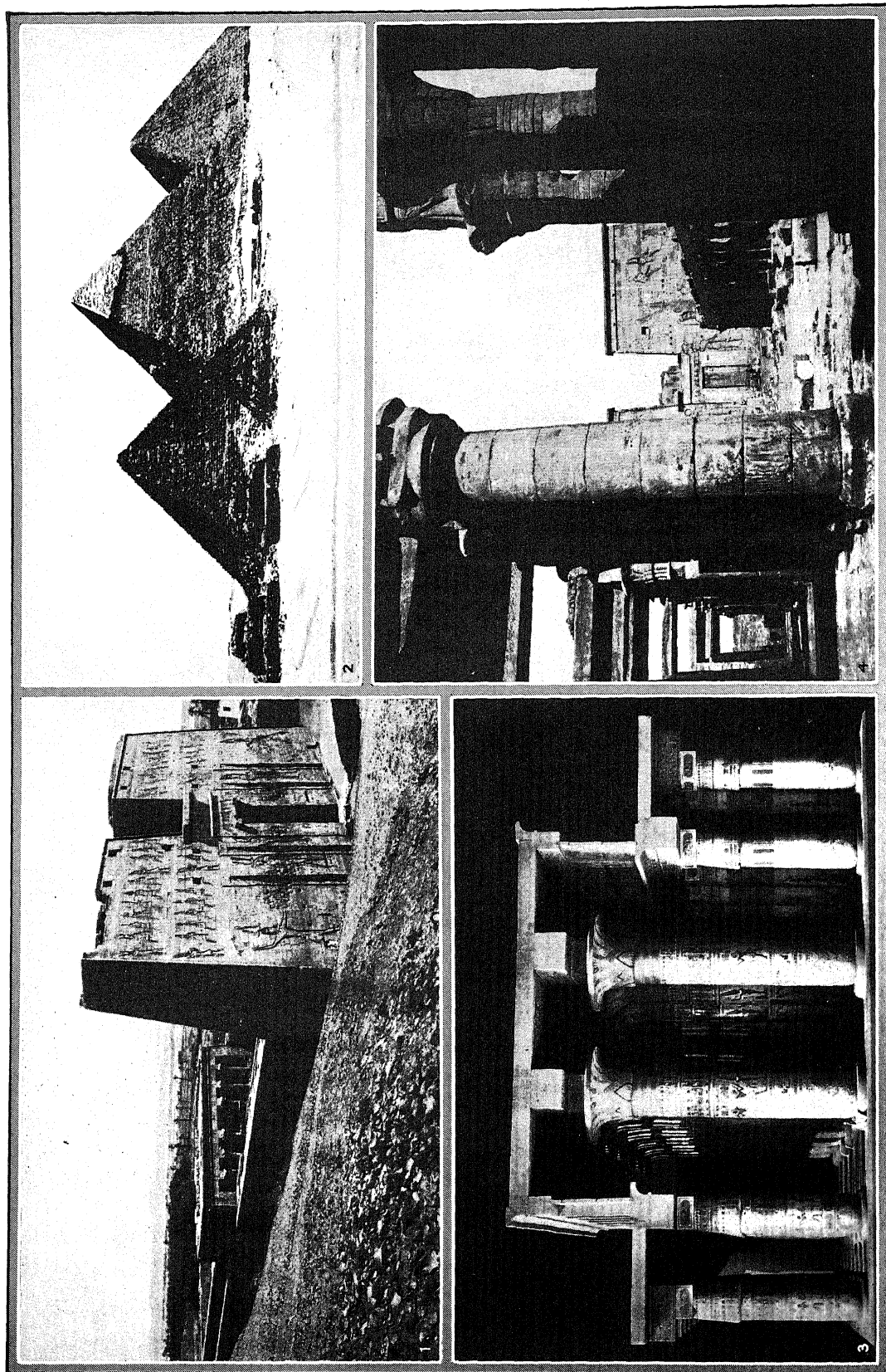
Many primitive tribes of the present day use forms quite similar to the Neolithic forms, and give a good idea of their appearance and functioning. The dome-shaped huts of the Patagonian Indians in South America show a most primitive form of the circular hut; the Indian tipis, covered with bark or skins, a simple type adapted to semi-nomadic tribes. Turkoman tents are remarkable as showing the complexity and richness possible through the development of primitive architectural ideas. The river dwellings along the rivers of Burma and Siam are probably not unlike the villages of the Lake Dwellers, and the rectangular shacks common along the Caribbean coast of Central America, with wattle and daub walls (mud



1. 4. COURTESY AMER. MUS. OF NATL. HISTORY; 2. M. M. OF ART; 3. THE COLORADO ASSN.

## PRIMITIVE DWELLINGS AND TEMPLES

1. Model of Stone Age lake dwellings in Switzerland.
2. Stonehenge, Wiltshire, England, a reputed Druid temple.
3. A cliff dwelling, Balcony House interior, Mesa Verde National Park, Colo.
4. Visayan village street, Philippine Islands, showing raised huts.

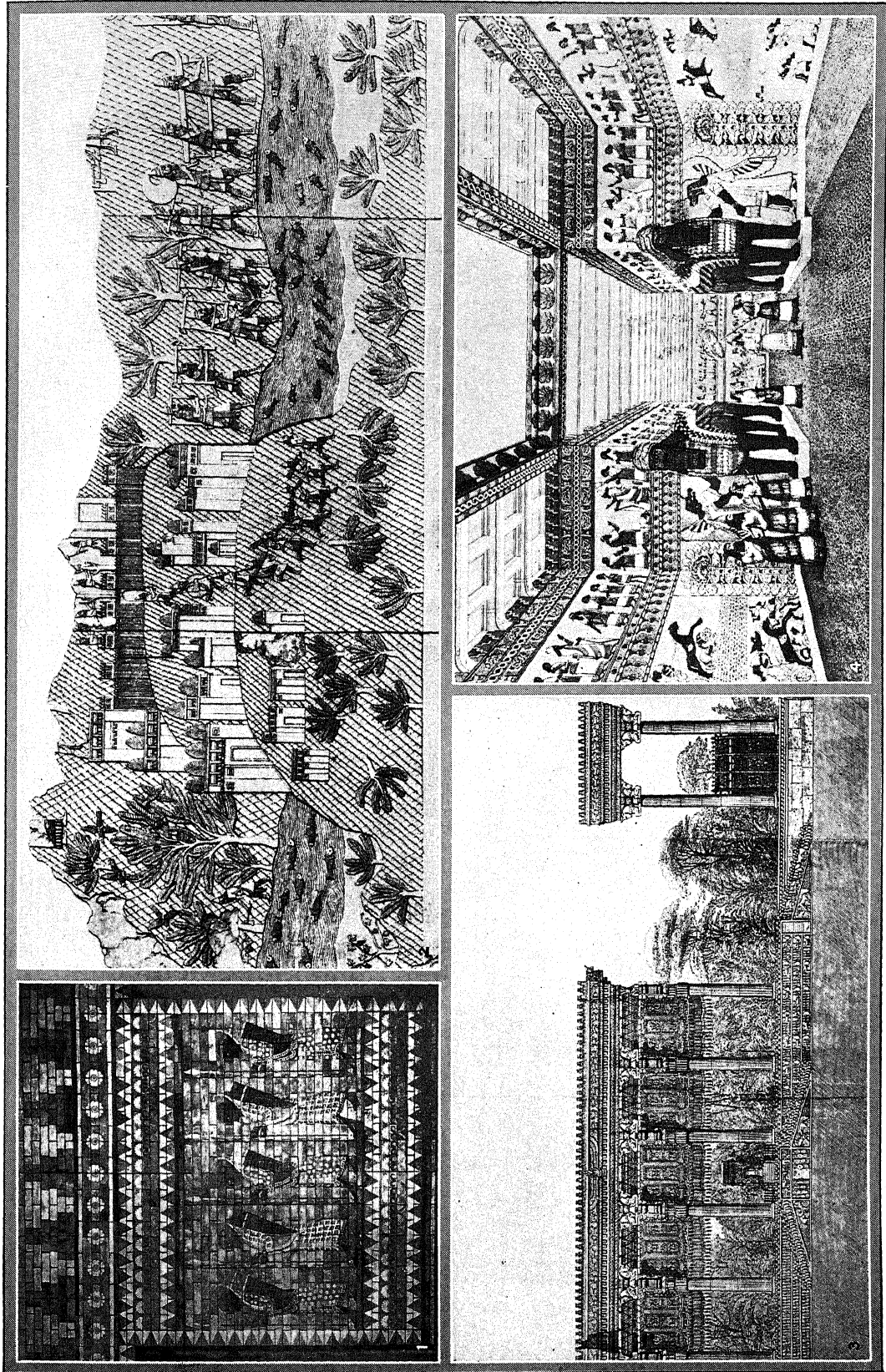


3. COURTESY METROPOLITAN MUSEUM OF ART

## TEMPLES AND TOMBS OF THE ANCIENT EGYPTIANS

1. Great carved pylon of the Temple of Horus at Edfu, Ptolemaic and Roman periods.
2. Pyramids of Cheops, Cephren and Mycerinus, Giza.
3. Model of the hypostyle hall of the Temple of Isis on the Island of Philae in the Nile, Ptolemaic Period.
4. Outer court of the Temple of Isis on the Island of Philae in the Nile, Ptolemaic Period.

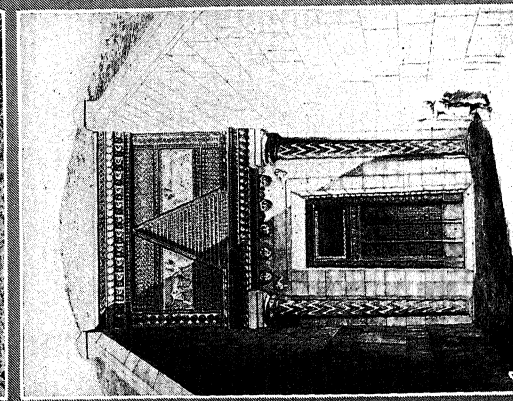
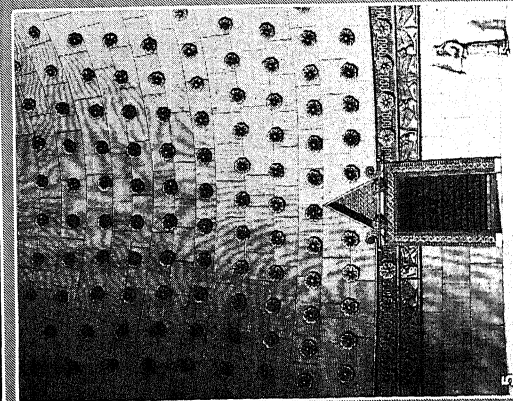
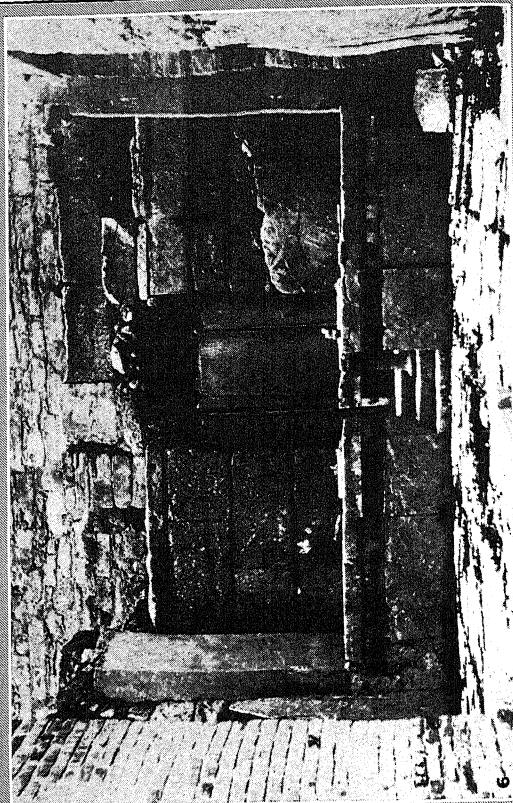
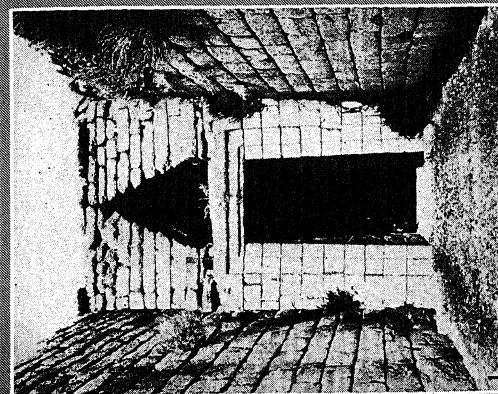
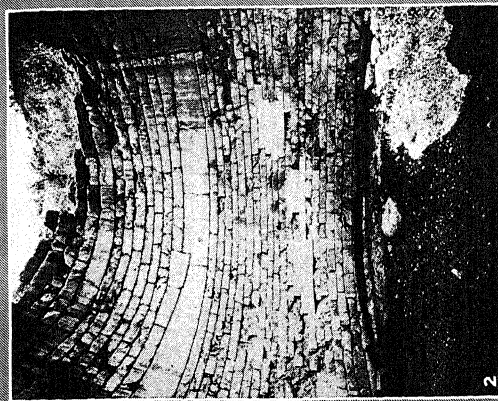
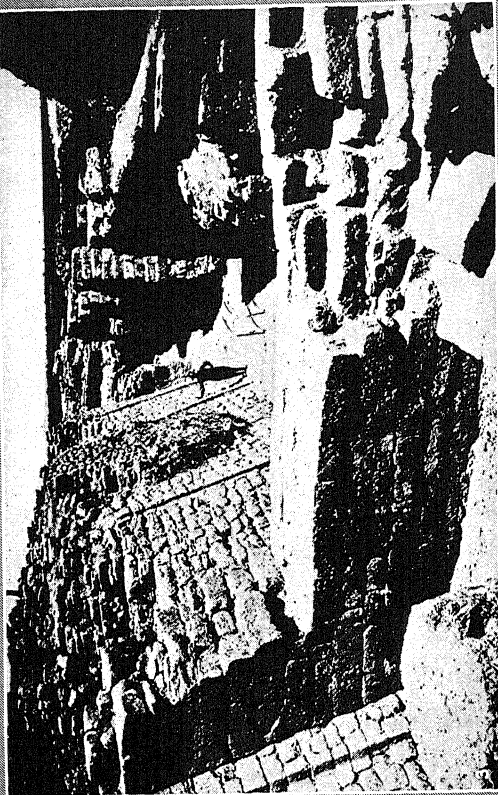




1. COURTESY METROPOLITAN MUSEUM OF ART; 2. 4. FROM SIR AUSTEN H. LAYARD, MONUMENTS OF NINEVEH; 3. FROM GEORGES PERROT AND CHARLES CHIZEP, A HISTORY OF ART IN PERSIA

### ARCHITECTURE AND DECORATION OF ASSYRIA AND PERSIA

1. Frieze of enameled brick showing Persian warriors advancing into battle, from the Palace of Artaxerxes II at Susa, now in the Louvre.
2. Bas-relief from Nineveh, of the siege and plunder of a city, showing characteristic wall, gate and house forms.
3. Restoration of the Hypostyle Hall of Xerxes, Persepolis.
4. Hall in an Assyrian temple or palace of Nimroud or Khorsabad.



4, 5, FROM GEORGE PERROT AND CHARLES CHIFFEZ, A HISTORY OF ART IN PRIMITIVE GREECE

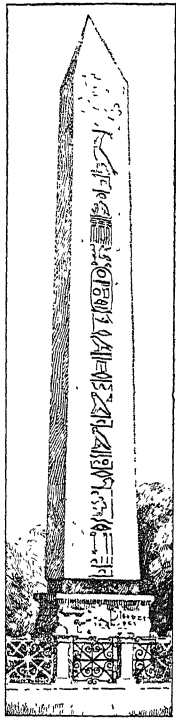
## ARCHITECTURE OF THE AEGEAN CIVILIZATION

1. Exterior of the tomb called the Treasury of Atreus, Mycenae, the dromos, or passage of approach, and inner portal.
2. Interior of the tomb called the Treasury of Atreus, Mycenae, the dromos, or passage of approach, and inner portal.
3. Great tower of the Sixth City of Troy.
4. Restoration of the tomb called the Treasury of Atreus.
5. Part of the cupola in the restored interior of the same tomb.
6. Throne room of the royal palace at Knossos, Crete.

plastered on a lathing of roughly woven twigs) and high pitched roofs thatched with cocoanut palm leaves, are undoubtedly typical of many of the residences of prehistoric primitive man. Menhirs are still erected in various parts of the world, notably in the Naga country between Assam and Burma, and in Madagascar.

Thus during the Neolithic period, there developed two main types of construction: masonry, of stone or mud bricks; and wood, of saplings, boughs, or tree trunks tied and lashed together. There appeared also the beginnings of many important structural techniques which needed only the coming into use of metals to develop swiftly into the developed trades of brick making, plastering, and carpentry.

**Early Centers of Development.** Architecture seems to have developed along with the beginnings of civilization as we know it, in three different centers at approximately the same period, roughly about 5000 B.C., China, Central Southern Asia, and the Nile Valley. There is the probability of a fourth independent center, along the northern coasts of the Mediterranean, especially in its eastern part, the Aegean center, and the possibility of two others, one in Central Europe, represented by the remains of the Lake Dwellers, and one in Central America. The whole question of the relationships in time, and in influence, of these various centers is still much in the dark, as is also their racial background. The Chinese center remained isolated for aeons from the centers further west, and therefore had little direct effect upon the development of western architecture. (See CHINESE AND JAPANESE ARCHITECTURE.)



OBELISK OF THEODOSIUS AT CONSTANTINOPLE

**Egyptian Architecture.** EGYPTIAN ARCHITECTURE, throughout the greater part of its 2500 years, was the product of a culture remarkably consistent in its basic ideas. This consistency of an almost unbelievable conservation enables one to see in the later, more highly developed and better preserved examples the crystallized forms of more primitive types. It is an architecture that shows with perfect clarity the effects of climate, available material, culture and religious ideals. This architecture as we know it is essentially one of temples and tombs, for the Egyptian conception of the gods and life after death led them to build their temples and tombs or commemorative monuments of permanent materials. Egypt was a theocratic country with the temple and the king existing together as the center of life. Yet it was also evidently a gay and pleasure-loving country with a high standard of living, for a large number of wealthy nobles, supported by the efforts of enormous numbers of

slaves, who probably found in the religious holidays, festivals and rites not only their only opportunity to enjoy themselves, but also an embracing sense of mystery, a continual sense of the beyond. And it was a civilization haunted always with the present sense of death. Thus Egypt built stone temples and the PYRAMIDS, luxurious villas of flimsy materials, known to us only through tomb paintings, and towns of narrow streets and crowded tiny houses built of unbaked brick. The Egyptians loved color, in textiles and in paint, on the lasting stone of temples, as well as on the more perishable wood and plaster of houses.

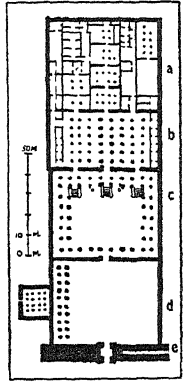
Egyptian tombs fall into four classes, and behind their development lies a continually increasing fear of looting and sacrilege. The first type is the mastaba, a truncated pyramid of stone enclosing a chamber and covering the mouth of the deep shaft leading down to the burial chamber. The mastaba was common in the earlier dynasties, and its wall decorations have thrown much light on the early Egyptian houses, showing representations of matting screens and the like. The second type, also common only in the early dynasties, was the Pyramid. Both mastaba and pyramid are cut stone interpretations of the primitive tumulus type. The third type is the rock cut tomb with an architectural treatment at the front, usually consisting of a little portico leading into a room with four columns. This type is especially common at Beni-Hassan, and was most popular about the 12th dynasty. The great memorial temple of Queen Hatshepsut at Dair-el-Bahri is a monumental development of the same essential type, though the architectural frontispiece is here of constructed masonry, and not rock cut. The last type is the deep shaft leading into the side of a hill, with the entrance concealed, and the burial chamber at the end. It was the type generally used in "The Valley of the Kings," during the period of the 18th dynasty and later.

The earliest known Egyptian temple, the so-called Temple of the Sphinx, near the Sphinx and the pyramids at Ghizeh, reveals the type of hall with many piers close together that later developed into the Hypostyle, or columnar, halls of the later temples. With roof as well as walls and supports of stone, narrow spans were necessary. The temple associated with the pyramid at Saqqarah illustrates another type of early temple, in which courts as well as columnar halls became important.

The developed type of temple, whose form may best be judged by the very late temple at Edfu, consisted of three main portions: a court in front, usually colonnaded; a great hypostyle hall, open to the court; and behind that a complex of smaller rooms growing gradually lower, smaller and more secret, with a sanctuary or Holy of Holies somewhere towards the rear. The front side of the court, which was the highest portion of the temple, consisted of two great truncated pyramids, known as pylons, with a monumental entrance between. Often this gate was flanked by obelisks, and the pylons bore staffs with banners; sometimes the whole was approached by an avenue



between rows of sphinxes. A solid impenetrable wall surrounded the whole, giving an air of mystery and inviolability. It is probable that only free Egyptians were admitted to the court, and only priests to the secret places within. This is the type of temple that was universal in Egypt for at least 15 centuries. The larger groups at Karnak and Luxor were merely more highly developed examples, or groups of smaller temple units combined into one.



A. D. F. HAMLIN, A HISTORY OF ARCHITECTURE (LONGMANS, GREEN)

PLAN OF THE RAMSESSEUM, SEPULCHRAL TEMPLE AT THEBES, EGYPT

a, Sanctuary; b, hypostyle hall; c, second court; d, entrance court; e, pylons

Although the actual size relationships of the temple were dictated by the use of the stone so available from the cliffs of the Nile Valley, the decorative forms with which the stone was cut were principally developed from an earlier system of building. Thus the battered walls and truncated pyramidal pylons probably owed their origin to building in sun-dried brick, a material both heavy and of little strength, so that the higher a form was, the greater the weight and the breadth necessary to support it. The convex moldings at the corners of stone forms and across the top were undoubtedly reminiscences of a method of building in which supports and beams were made of bundles of reeds lashed together, and the orna-

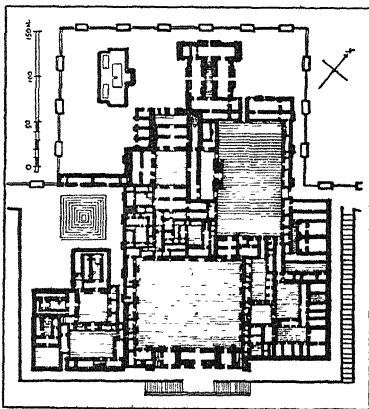
ment of the stone moldings bore was a representation of the lashing. The concave cornice at the tops of the walls and pylons was also interpreted as a stone representation of the tops of the wythes which formed the lathing between the reed supports bent out by the tamping down of a heavy clay roof behind them. Similarly, one of the types of columns, the clustered lotus bud column, was a reminiscence of early methods of building posts by tying together a bundle of papyrus stalks. The lotus bud capital was probably due to the custom, frequently represented in tomb paintings, of decorating posts and columns by tying lotus bouquets to them. Even when the lotus bud column was plain, and not clustered, there were evidences of a similar parentage. The great bell shaped capitals, called Campaniform, used on the largest columns were probably based on the flowering papyrus, and the palm leaf capitals, appearing in the temple at Saqqarah as early as the 5th (?) dynasty, were simple conventionalizations of palm trees, and probably indicate a common early use of palm trunks as posts. Another source of Egyptian column design is seen in the polygonal or fluted columns especially common in Saqqarah and Beni Hassan. The tombs at Beni Hassan show the source of this form lay in rock-cut square piers, whose corners were progressively chiseled off to diminish bulk, with the least disturbance of strength. The resulting polygonal pier was then fluted to emphasize the vertical edges at the angles.

Egyptian buildings, because of their simple architectural forms and the uniformity of material, required a lavish use of surface ornament to give scale, that is, the quality which makes a building look its true size. In temples and the earlier tombs, this ornament was usually in low relief sunk below the enframing surface (*cavo-relievo*), richly colored; in late tombs painting alone was found. The usual method was to divide a wall or column into horizontal bands or zones, each with a succession of pictures with accompanying inscriptions; occasional large subjects broke up the monotony. The extreme realism of the earlier dynastic sculpture, as in the tomb of Ti, yielded to much conventionalism later. But almost always the Egyptian architectural sculptor was a master in creating beautiful rhythmical patterns in relief, in using the hieroglyphic inscriptions in the most ornamental way, and in always feeling conscious of the decorative rather than the representational purpose of his work. The most common of the conventionalized ornamental motives of Egyptian art was the lotus. This flower came to be a symbol of the Nile, of fertility, and was used everywhere for bands, over all patterns, even the decorations on perfume spoons. (See EGYPTIAN ART.) The lotus was conventionalized by the Egyptians into a series of forms that were copied, adopted and adapted by almost all the peoples of the Eastern Mediterranean and of South Western Asia. Assyrians, Persians, Phoenicians, the people of Aegean culture and the Greeks all used the Egyptian lotus flower, lotus bud and lotus palmette as an inspiration to much of their own decorative work.

**The Tigris-Euphrates Valley.** The origins of the civilization of the Tigris-Euphrates Valley seem independent of those of Egypt. Many indications point to migrations from points perhaps in northern India, or the settling of two branches of a common stock, one in the Tigris-Euphrates Valley, and the other in the Valley of the Indus. During the period prior to the Assyrian domination, there developed in Sumeria and Babylonia a local architectural style which was little influenced by Egypt, and which had common characteristics throughout the valley, irrespective of whether its builders were the original settlers of Ur and the southern cities, or invading Semites. The great characteristics of this architecture were a massiveness resulting from the use of sun-dried bricks, the use of applied sheathings of metal, wood or plaster to protect this adobe from the weather, and the early discovery and development of the arch and vault. Its chief works were palaces, temples and tombs; frequently a palace and a temple were combined in one great composition. The palaces were usually rather formless aggregations of small rooms around one or more courts. At the rear in a court of its own rose the great stepped truncated pyramid, the ZIGGURAT, which was the almost universal form of the temple. The tombs consisted of one or more chambers, often vaulted in brick, within an enclosing wall. Apparently the whole area inside the wall was buried deep in earth immediately after the interment. In all of these types

of buildings the architectural forms are of the simplest. All sense of richness must have come from the plaster coating, sometimes painted in bright colors, and from rich applied elements, as seen in metal sheathed doors, and sometimes gaily painted wooden porches. There was probably also a lavish use of textiles. Towards the end of the pre-Assyrian period, the technique of baked brick relief was perfected, and the lower parts of the walls were frequently decorated with continuous friezes of brick reliefs, almost always of imaginary beasts. This type of decoration was developed to a high point by the Assyrians.

The Assyrian empire that dominated the valley roughly from 1000-700 B.C. adopted all the local building techniques, but added many other elements, particularly its borrowings from Egypt, with which it was in constant contact, sometimes friendly, sometimes hostile. Thus we find the lotus and the lotus palmette common motives in Assyrian ornament, and even the



A. D. F. HAMLIN, HISTORY OF ARCHITECTURE  
(LONGMANS, GREEN)

PLAN OF PALACE OF SARGON AT KHORSABAD, TURKEY

Assyrian sacred tree pattern is compounded of elements some of which are obviously of Egyptian inspiration. The great works of Assyrian architecture are all palaces. In these, arched gates between towers with stepped battlements led into great courts surrounded by long narrow rooms, possibly vaulted with barred vaults. There were evidently high windows with colonnettes for mullions. The whole was built on a high platform and carefully drained with vaulted drains. Reliefs show that the Assyrian small houses were sometimes roofed with high ovoid domes. As in Ur 1000 years earlier, a temple ziggurat was in every palace compound.

**Persia.** The Persian empire evidently brought down in the Tigro-Euphrates Valley a tradition of wooden building gained in the forested north. Yet, like Rome later, the Persians had no highly developed decorative art or any architectural forms to express the wealth and the luxury their conquests brought. So they borrowed everywhere; they produced possibly the first thoroughly eclectic architecture in the world. From Egypt they borrowed the cavetto cornice and

the pylon form; from Asiatic Greece the fluted stone or marble column; from Assyria the winged bulls that flanked gateways, the whole panoply of Assyrian ornamental motives, and the Assyrian skill in burned and glazed colored brick relief. The remains of Susa and Persepolis show the essential forms of this Persian architecture. Palaces consisted of great columnar halls, with smaller rooms around; columnar porches were common, and at Persepolis there was a monumental gateway to the whole group. The columns were tall, slim and fluted, and carried characteristic bracket capitals, with the bracket ends carved with horses or bulls. Doors and windows were framed in stone with Egyptian type cornices. The walls were of sun-dried brick and have perished. The flat roofs were carried by girders and beams of timber; the outside treatment shows a large banded girder, with little projecting beam ends above.

**Other Western Asiatic Architecture.** The Hittite empire, powerful in Asia Minor and the northern part of the Tigro-Euphrates Valley for several hundred years, has left remains entirely different in character. Essentially a northern power, speaking a language of Aryan type, the Hittites were a military people, pressing down into the hospitable climate of the south by force of conquest. They were builders of great fortresses, whose designs influenced the military architecture of Syria, Assyria and even Greece. In the palaces of masonry which they erected a new type appeared, the great central chieftain's hall, with a porch, like the Mycenaean and Homeric Megaron. They used columns of wood and occasionally of stone, as in the strange portico in the palace at Tell Halaf, probably third millennium B.C. In their decorative art there was something savage and grotesque, in spirit not unlike some of the early Romanesque work. Columns were apparently often carried on the backs of beasts. The portico mentioned above, now in Berlin, is a good example of this. In portions of Asia Minor, notably Lycia, there are groups of rock cut tombs, some free standing, but monolithic, notable for their representation of framed timber forms. The timber technique was advanced; almost all members were squared, paneling was used, and the structural members were used in a decorative way. These tombs, of uncertain date, are important as showing a kind of wooden building whose influence was great alike on Persian and Greek design.

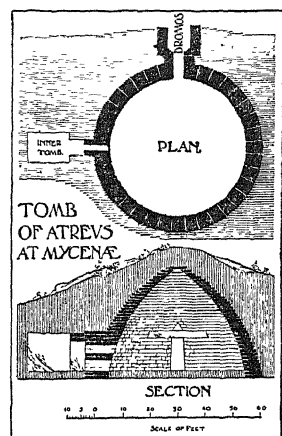
Along the Syrian coasts, influences were strangely confused. Settled by Semitic tribes, without definite building traditions, for centuries the chosen battleground between the empires of Egypt and Mesopotamia, it is not strange that this country produced an architecture that was a mixture of many elements. We know it best from the descriptions given in the Bible of the Palace of Solomon and the great temple at Jerusalem. Timber was used structurally, there was enormous lavishness of metal sheathing, and there were decorative embellishments with motifs taken alike from Assyria and Egypt. The structure, at least of Solomon's portion, was largely the work of Phoenician

craftsmen, and the great twin pillars that flanked the entrance of the temple are shown in Phoenician shrine models; they were probably of Phallic origin. The importance of the Phoenicians was less in their own work than in their commerce, which was instrumental in the distribution and exchange of the manufactures and the forms alike of Mesopotamia, Egypt, Syria and the Aegean Islands, and later of Greece.

**Aegean Architecture.** In the Islands of the Aegean, especially in Crete, which was the dominant locality, there grew up a local civilization, produced first apparently by a race that was scattered along both the north and south shores of the Mediterranean in Neolithic times. It developed an early climax under the influence of copper, introduced by settlers or invaders from Asia Minor. Its architecture, markedly different from that of any other peoples, is best seen in Cnossos, Phaestos and Gournia in Crete. This

shows an early development of fine technique, alike in stone masonry, brick work and timber. It is the architecture of people with a generally high level of culture and comfort, dwelling in close built towns with houses often of several stories. The round hut, the house, consisting of a group of huts, the oval form, represent the earliest Neolithic house types. The development of rectangular shapes can be traced in the remains, and the palaces of the era 2000-1500

B.C. show the final flower-



FROM F. M. SIMPSON A HISTORY OF ARCHITECTURAL DEVELOPMENT. LONGMANS, GREEN & CO.

ing of a complete whole, with many rooms for different purposes, richly decorated with painting, and grouped informally around a great court and many little courts. Columns of wood were used as important structural supports; they tapered downward, the small ends resting on cylindrical bases, the large ends carrying spreading cushion shaped capitals with a square abacus or flat top block. Paintings and pottery plaques show many houses with several stories of windows, sometimes with mullions or vertical subdivisions, and temples with columned fronts and horns at the corners of the roof, a reflection of the current bull worship. In decorative detail there is evident a love and knowledge of the sea. Shells, fish, seaweed and the octopus are common motives; and in most of the decoration there is a delight in motion, in realistic, almost impressionistic representation that is unique. Many ceiling patterns show very definite imitation of Egyptian work.

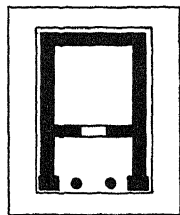
On the mainland of Greece the earlier Aegean race was apparently conquered and absorbed by a wave of immigration from the north in a gradual infiltration from about 2000 B.C. The new comers, called Achaeans, however, took over large elements of the

Aegean culture, using Aegean decorative motives, with little change, but modifying palace ideas in accordance with their own customs. This Achaean culture of the Greek mainland and Troy is called Helladic; that of Crete, Minoan.

The most important architectural feature of the Helladic or Mycenaean palace was the megaron, which had a formality of treatment unknown in Crete. The megaron was merely an architectural development of the primitive chieftain's hall, somewhat like that of the Hittites. The developed megaron as seen especially at Tiryns, c. 1200 B.C., was a large rectangular room whose side walls were continued out beyond the front to enclose a porch. The roof of the hall was held up by four columns, with the hearth in the center; above these was a hole in the roof to let out the smoke, or possibly a clerestory treatment. In the porch there were two columns between the ends of the projecting walls. Remains of the simpler types, without columns or with only one central row, have also been found. It was the developed megaron which furnished the inspiration for the later Greek temple. Helladic culture has an additional interest due to the fact that it was the culture upon which the Homeric epics were originally based.

**Greek Architecture:** (See also GREEK ARCHITECTURE). The Dorian conquest of Greece, about 1100-1000 B.C., was succeeded by nearly 400 years of architectural struggle to adapt various features of Aegean and Mycenaean forms to the Greek traditions and methods. At first all building seems to have been of wood and sun-dried brick; only in the 7th century was there a start of monumental stone building, probably in the cities under the rule of the famous Tyrants, in Sicily. From then on the development was rapid, until the climax of the DORIC STYLE was reached in Athens in the second half of the 5th century.

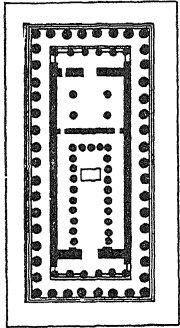
The Greek temple was a development of the Achaean and Mycenaean megaron plan. The earliest Dorian shrines were probably altars in open spaces.



PLAN OF THE TEMPLE OF THEMIS AT RHAMNUS

The desire to enclose and protect a cult statue made the early builders turn to the most appropriate model, the central hall of the Homeric palace. At first, with one row of supports down the center, this hall was later enlarged so as to have two; and a porch, similar to the old palace porches, was added at one or both ends. The ends of the projecting crude brick walls that enclosed the porch sides were cased with wood for protection; this led to the development of the ANTA, a pilaster-like form. Between the antae (in antis) were the porch columns of wood, with capitals like the spreading cushion capitals of the Cretan palaces. Later colonnades were added around the sides, and the Greek temple form was complete. Growing skill in stone building led gradually to the use of stone columns, beams, gable ends or pedi-

ments, and eventually walls, but in this change many of the earlier wooden forms were recalled. Thus the Aegean type of capital was preserved, though gradually more and more refined into the Doric capital, and the entire entablature, or the beams and eaves of the roof, was an interpretation in stone of wooden forms.



F. M. SIMPSON, A HISTORY OF ARCHITECTURAL DEVELOPMENT LONGMANS, GREEN

PLAN OF PARTHENON, ATHENS

Meanwhile, in Asia Minor, under different, oriental influences from the Syrian coast and Egypt, the Ionic order was taking form. Various types of lotus palmette, with great spiraled side petals, were common in Phoenician work and had come to be used to cap memorial upright stones, called stelae, and even pedestals. The Ionic capital was merely an application of this common form to a bracketed post cap. In the early examples a band of drooping leaves separated the cylindrical column from the scrolled brackets; but this was soon discarded,

and the scrolls gradually made smaller and more refined. By the 5th century the typical shape had been developed, and its use had spread from the Asia Minor coast to the mainland of Greece. The Ionic entablature, like the Doric, was a stone interpretation of original wooden beams. The third of the Greek orders, the Corinthian, was a much later development, apparently of the 4th century. Bell shaped capitals had been common in Egypt. If the bell is surrounded by one or two rows of leaves, the Corinthian type results. The final development came with the addition of scroll forms to bend out and support the corners of the abacus.

The secret of the greatness of the Greek architecture is to be found not so much in the details of its forms as in the way in which these were changed, and the use made of them. The Greek was traditionally curious, sceptical and artistically dissatisfied with his own past achievements. Every detail of aesthetic form was forever being questioned, experimented with, perfected. The field in which this refinement took place was limited; the Greek temple type remained essentially unchanged, and there were few startling innovations in the development of the orders. Yet this very limitation resulted in a remarkable intensity of effort, and a perfection of result as yet hardly matched. Column and entablature proportions were constantly fluid. The effort to produce repose and aesthetic satisfaction in the complete building led to modifications in column spacing, the inclination inward of the column axes, the careful study of the swelling curve or entasis of the column taper, and finally to the subtle curvature of the lines of the steps and the entablature. This apparently endless and loving care of minute details resulted in a beauty of perfection. Other reasons for the greatness of Greek architecture are the restraint, appropriateness and delicacy of carved ornament, the

brilliance of color decoration, and the perfection of sculptural embellishment. The pediment groups of statues, the sculptured metopes, or square panels between the upright grooved blocks known as triglyphs, in the entablature, and occasional continuous friezes like the famous Parthenon friezes, all give evidence of the same search for perfection of conception, composition and detail that characterized the architectural forms.

The Greeks summed up, developed and recreated almost all the tendencies of the earlier architecture of the eastern Mediterranean and western Asia. They borrowed forms wholesale; accepted any inspiration to be found. Aegean, Syrian, Egyptian elements were common, and the influence of the wooden architecture of Asia Minor can be traced. Yet these borrowed forms were never copied. Each was used as inspiration only, modified, and finally emerged as a creation not of Egypt, Syria or Asia Minor, but of Greece and the Greek genius.

**Hellenistic Architecture.** Such an architecture as that of Greece, with its limited problems and its intense search for perfection along limited lines, had in the achievement of the perfection it sought, the seeds of its own death. No further growth was possible without the introduction of new problems and new ideals. Such an introduction of novelty occurred only with the orientalizing of classic life that resulted from the campaigns of Alexander the Great, which saved Greek architecture from its moribund condition in the 4th century, and aroused it to a new and different flowering. But it was in the Greek cities of Asia Minor, and not in Europe, that this second blooming centered, and it is often termed Hellenistic architecture. The aims of Hellenistic architecture were size, grandeur, luxury and lavishness, instead of the restrained perfection of the earlier work. Great groups, formally planned, became the rule. There was a new magnificence in civic architecture, a new luxury in house design. Architectural sculpture became dramatic, personal, realistic. Naturally the simplicity of the Doric order went out of fashion, except for house courtyards and agora colonnades. The great Hellenistic temples were all in the more graceful and elaborate Ionic, and even the details of that order were enriched with carving that an earlier day would have found only superfluous. Priene, Didyma, Pergamon, Halicarnassos and Ephesus all show a similar desire to create magnificence. It was a Hellenistic Greece that Rome eventually mastered and absorbed, and along with this process of conquest and penetration went the gradual absorption by Rome of many of these Hellenistic ideals.

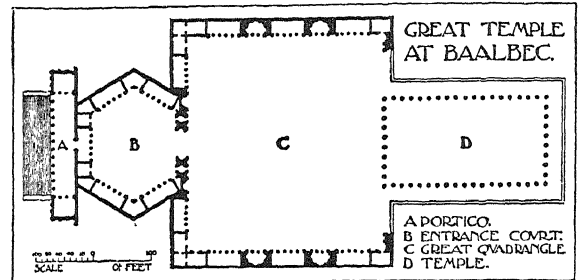
**Roman Architecture:** (See also ROMAN ARCHITECTURE). The northern portion of the Italian peninsula had developed a strong culture of its own in the 8th and 7th century B.C., which centered in Etruria. Etruscan architecture, known to us principally through tombs, vaulted drains, gates and the ancient descriptions of Etruscan temples, was a vivid

art, strongly under two differing and contrasting influences: one, the influence of Greece, through direct commerce, especially in pottery, and through the less direct contact with Greek colonies in South Italy and Sicily; the other, an influence obviously Oriental, derived likewise from commerce or perhaps, as some have suggested, due to an original Oriental home for the Etruscan race. To these two influences in decorative form were added a native love of and skill in building, especially the early development of the stone arch, and also a grotesque feeling not unlike that of the Hittites.

The typical Etruscan temple shows this mixture of influences. A nearly square enclosed portion, or cella, was fronted, and sometimes also bordered on the sides, by a colonnade carrying wooden beams and wide overhanging eaves with a gable roof of low pitch. The wooden beams and cornice were often faced with terra cotta decorative revetments. In the columns there may have been a distant recalling of the primitive Greek Doric, and many Greek patterns occurred in the terra cotta decorations. But the basic shape of the temples was not Greek, and the proportions of the columns and roof treatment were different. In the decoration there was much use of human faces or figures treated in a grotesque manner, and in tomb decoration there were often pier capitals that were lotus palmettes distinctly Syrian in form.

As the power of Rome grew and spread over Italy, Roman architecture was at first naturally under dominantly Etruscan influence. Later in the Republican days, the influence of the Greek work in southern Italy was more and more felt. But it was only under the stimulus of the final conquest of Greece that Roman architecture was born, and to the basic common-sense structural skill of the early Italian was added the Hellenistic love of size, monumentality and lavishness. Rome's great contributions to architecture lay in the amazing practical applications of those Hellenistic ideals, and the enormous development of structural genius necessary for this application. The Romans were masterly organizers architecturally as well as politically. Planning, in its modern sense, that is, the ordered organization of many different features into one coherent whole so each has its proper relation, practically as well as aesthetically, was created by the Romans. Structural genius in the enormous development of the arch and the vault into a basic system of building is another example of the Roman organizing ability. The great intersecting vaults of Rome not only allowed the use of a few massive supports, widely spaced, but also for the first time permitted the creation of vast, unencumbered spaces. The dome of the Pantheon, c. 110 A.D., is but one of many examples. Moreover, the Roman was less interested in devising new temple forms, although the great barrel vaulted interiors of the temple of Venus and Rome at Rome or of the Sun at Baalbek were new conceptions, than in developing all sorts of facilities for comfortable, amusing and

luxurious living. Baths, amphitheaters, palaces, lavish houses and villas, monumental fora, public halls or basilicas, public walks or porticos, dock and harbor schemes like those of Ostia, aqueducts and bridges were the great works of Rome, to the design of which the Roman architect brought his greatest ability to analyze, arrange, organize and construct.

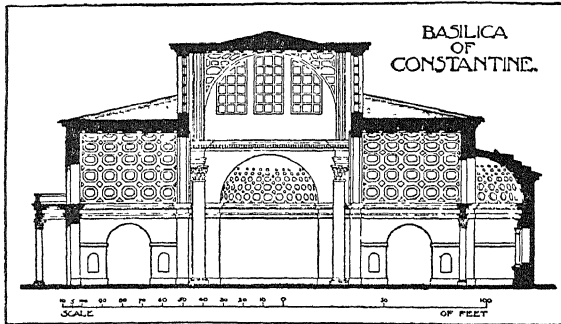


FROM F. M. SIMPSON, A HISTORY OF ARCHITECTURAL DEVELOPMENT  
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It is characteristic that in the effort to get results quickly and efficiently, the Roman developed a constructive system of cheap materials, brick and concrete, usually building the bones of his structure with these, and then adding applied decoration of plaster or marble. The careful cut stone technique of Greece was not quick enough. However, the Roman never let himself be bound by the conventions of the usual. In Syria, where stone was plentiful and cheap, he did not hesitate to build great vaults of cut stone. In general the Roman system was largely one of building first and decorating afterwards. Roman decoration was at its best when it most clearly recognized this fact, as for instance, in marble sheathing like that of the Pantheon, in wall painting like that of Pompeii, or in delicate plaster relief. Similarly frank decorative uses of the orders were common, and the Roman architect had a genius for such imaginative uses: ranging columns in tiers against a high wall, as in the Library front at Ephesus; stringing them in a screen across a recess, as in some of the baths, or applying them against the piers of an arcade, as in the Colosseum. In porticos, temple colonnades, house courtyards, etc., the columns were, of course, structural.

Due to the Roman love of lavishness, the favorite Roman order was the Corinthian, and in its design the Romans achieved a great sense of ordered richness and big scale. They worked out for it a special and appropriate entablature, as the Greeks had never done, and associated with it carved ornament of charm, delicacy and variety. In all Roman ornament there was evident a love of natural forms, and even in grotesques and conventionalized acanthus forms, an attempt to give a naturalistic, even realistic feeling, much more allied to the naturalistic ornament of the Middle Ages than to the meticulous and abstract purity of Greek ornament. As Roman luxury developed, and Oriental influence in Roman life grew stronger and stronger, a decadence of decorative taste set in which put an end to the full, free naturalism of the

earlier work, and substituted crudity and a harsh, meaningless wealth of repetition. By the time of Constantine decorative skill had so far declined that the builders of his triumphal arch pillaged the arch of Trajan for appropriate ornaments. Yet structural genius continued growing; buildings grew lighter, more daring. The most perfect piece of Roman dome building, for lightness and efficiency, was the so-called



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BASILICA OF CONSTANTINE, ROME

temple of Minerva Medica, really the Nymphaeum of the Licinian Gardens, which was of the time of Maxentius. For another hundred years at least, the Roman architects continued to make experiments in new forms of vaulting.

**Early Christian Architecture.** There was little break in the tenor of Roman life caused by the official Christianization of Rome. Oriental religious ideas had for long been fashionable and growing in power. The bloody history of Constantine's family shows how little official Christianity affected the quality of government Rome received. In architecture the structural experiments continued to be made and decorative taste to decay. Yet the great early basilicas, of which St. Paul's Outside the Walls, rebuilt in the 19th century after a fire, gives the best idea, had magnificence and grandeur. They were effective because their builders so clearly recognized the decay of traditional Roman decorative skill, and based their effort upon new, entirely Oriental ideas, rich color and rich mosaic. Architecturally simple, columnar halls with clerestories and wooden roofs, they had the lower walls and floors covered with colored marbles, and upper walls and arches encased in mosaics. So much of the effect is due to this new use of marbles and mosaics, that the quality of architectural detail matters comparatively little. This so-called Early Christian architecture continued in use in Rome almost to the time of the Renaissance. And even when the economic and cultural collapse of Rome was complete, from the 6th to the 12th centuries, lovely basilicas were built, beautiful because of their mosaics and furniture and not because of their architecture. This was often, as in the case of San Lorenzo Outside the Walls, merely a combination of misfit Roman details pillaged from the most convenient ruined buildings, and piled together helter-

skelter. The death of Roman architecture was complete.

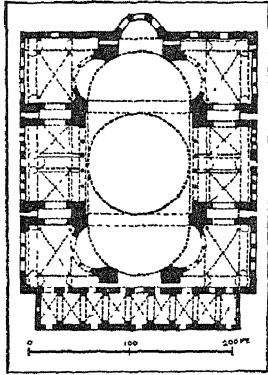
**Byzantine Architecture.** (See also BYZANTINE ARCHITECTURE). When Constantine moved his capital to Constantinople, he was not only realizing the growing importance of the eastern, Oriental element in Roman life, but he was making inevitable that blend of Oriental decorative and building ideas with Roman structural genius that produced the Byzantine style. As early as the time of Diocletian some examples of Roman detail, especially those in the great palace and military station he built for himself at Spalatro, c. 303, showed the signs of distinct modifications in ornamental forms. The rounded varying relief the Romans loved was here replaced with a tendency towards flat surfaces patterned with sharp, deeply cut lines and holes. The effect, brilliant intricate patterns of light and dark, was precisely that sought by the Byzantine architects 250 years later. Molding profiles tended to become straight splayed surfaces, and detail was piled on detail in a way unknown to the earlier imperial architecture. This change was probably due to the use of Syrian designers and workmen, for even earlier work in Syria showed the growth of a similar technique that was admirably fitted to the hard stone in which it was worked. To Asia, too, must be traced the growing importance of the dome. The whole subject of the architecture of the 3rd and 4th centuries in Asia Minor, Syria and Mesopotamia needs more research and study, but it is obvious that in many centers domed buildings and new types of structures for churches were being developed. Constantine's church of the Holy Sepulchre in Jerusalem was entirely different from his basilicas in Rome.

Yet Byzantine architecture reached a definitive development only with the marriage of this Asiatic influence to the still vivid Roman structural genius. The first result of this was the satisfactory solution of the placing of a dome on a square plan through the perfection of the PENDENTIVE. Four great arches over the four sides of a square gave a perfect basis for the pendentives, and thus a great square area could be enclosed with only four large supports at its corners. By combining domes with half domes, almost any shape could be simply and impressively covered. Byzantine architecture structurally was chiefly an architecture of domes, of few supports, and of a building built in the Roman way of cheap and easily handled materials. Decoratively, it was an architecture of the lavish lining of the structure with rich materials and of a carved ornament based on the fine pitting of the surface with deep cuts and holes, to give a delicate lace-like appearance. Moldings became less and less important, columns were used to carry arches directly, without an entablature, capitals grew simpler and simpler in outline, and more and more lace-like in surface treatment. Marble sheathing in panels was widely used, and most important of all, the Byzantine artists developed amazing technical and creative skill in using glass mosaics, usually with a



gold background, to cover vault surfaces and the upper parts of walls.

In the 6th century churches of St. Sophia in Constantinople and of San Vitale at Ravenna, the developed Byzantine type can be seen, with a ring of windows piercing the base of the dome. St. Mark's in Venice of the 11th century and later was another developed example, though

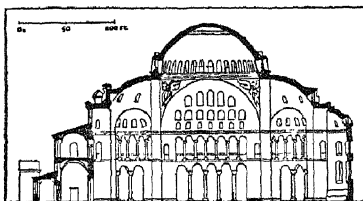


A. D. F. HAMLIN, A HISTORY OF ARCHITECTURE, LONGMANS, GREEN

PLAN OF THE CHURCH OF ST. SOPHIA AT CONSTANTINOPLE

with ornament influenced by Roman tradition, and an exterior local in type. The use of windows at the base of the dome led to the use of a cylindrical wall, known as a drum, in which they could be placed between the top of the pendentives and the bottom of the dome. The history of later Byzantine architecture, that lasted in Constantinople down to the fall of the city in 1453, was largely the history of the growing height and importance of the drum, and the diminution in the size of the dome itself, as well as in various experiments in exterior treatment, especially in the horizontal banding of stone and brick, and in the development of pilaster strips to break the wall.

The influence of Byzantine architecture was enormous, not only on all the areas under the control of



A. D. F. HAMLIN, A HISTORY OF ARCHITECTURE, LONGMANS, GREEN

SECTION OF ST. SOPHIA, CONSTANTINOPLE

the Eastern Empire, but also upon Italy generally, the Romanesque work of France, all of Russian architecture, and most of the Mohammedan styles.

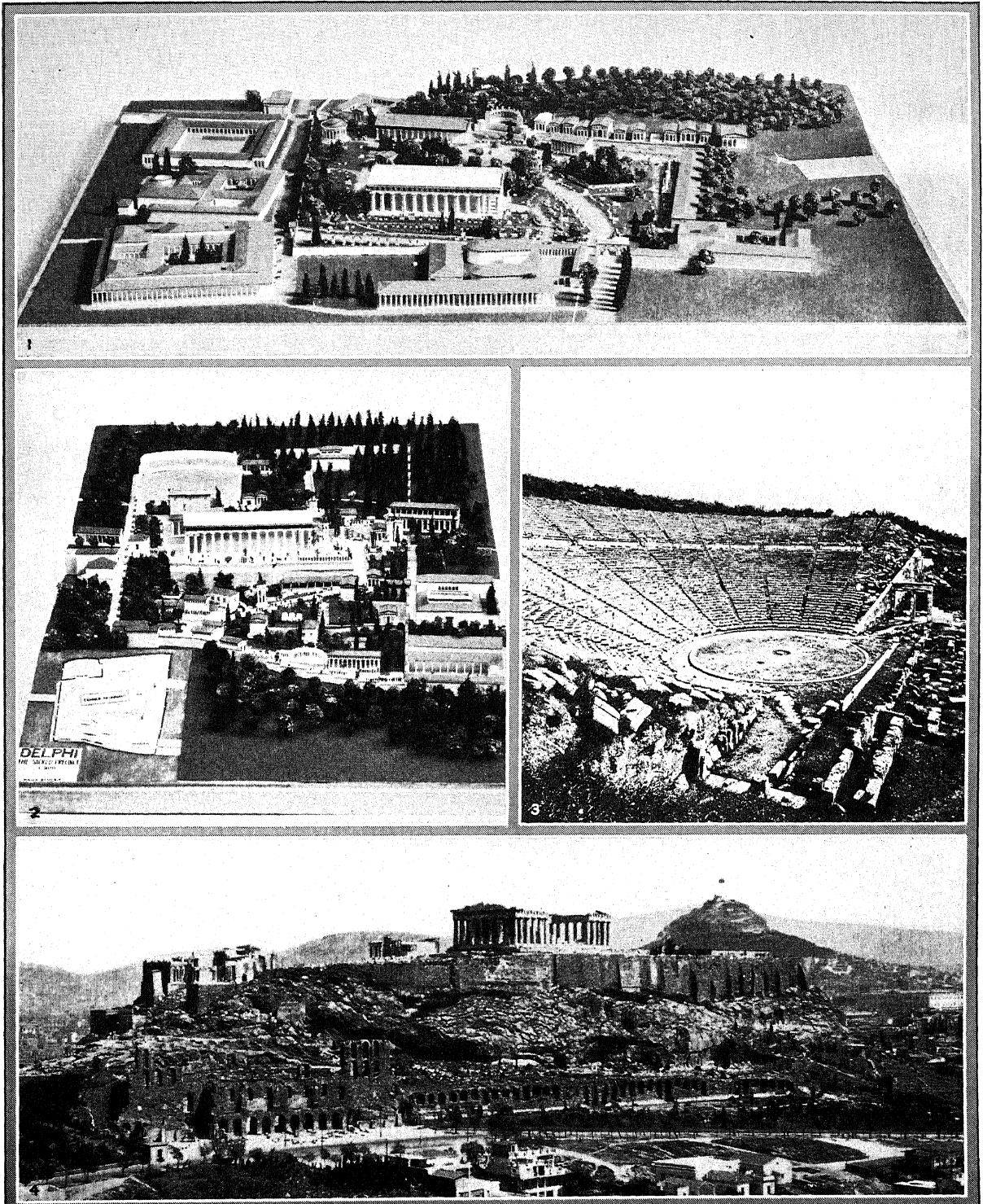
**Romanesque Architecture:** (See also ROMANESQUE ARCHITECTURE). In the western Roman Empire, the economic collapse of Roman culture and the disturbances resulting from the Barbarian invasions of the 4th and 5th centuries combined to make any such development as that of the Byzantine style impossible. Yet the Christianizing of the Teutonic and Hun tribes gave the new populations at least a superficial heritage in the remains of the Christian Roman empire. Moreover, as the invasions ceased and the disturbances quieted, the invaders settled down, intermarried with and absorbed, or were absorbed by, the older inhabitants. It was thus natural that imitation of Roman work should become their building ideal.

The lapse of three to four centuries, the Dark Ages, had, however, effectively killed the Roman structural tradition. Even in Rome itself the ransacking of old, decaying imperial buildings and the hit-or-miss use of the spoils was the accepted method of church construction. And where the proportion of invaders was greatest, as in Lombardy or parts of Gaul, building skill was only rudimentary. The only building of the period that was architecturally adequate was occasional work of the Carolingian empire, done under the direction of Byzantine craftsmen. Thus the church at Aachen was a purely Byzantine conception and the famous abbey gate at Lorch was a simple Roman derivative.

The emergence of a highly developed monastic system in the 10th and 11th centuries produced a great change. Not only did it furnish a new architectural problem, the monastery, but the monasteries themselves became the preservers and exchangers of all sorts of knowledge and skill, and also the lavish patrons of architecture, in a way, its creators. The architecture that developed was primarily the attempt to build basilican churches as nearly fireproof as possible, with methods not beyond the rude culture of the time, and to decorate them lavishly with ornaments fitted alike to the technique of the builders, and the psychology of the people. The losses from the burning of the earlier crude basilicas had been enormous, for although the structures had been poor, their enrichments in gold and silver and textiles had been lavish. Roman vaults were everywhere to be seen, and the idea of applying masonry vaults to the basilica was inevitable. The development of Romanesque architecture was generally the history of the growing skill of solving this problem, and at the same time producing a church with adequate window area for daylight lighting. In this effort, Byzantine and Syrian influence were often strong, as in the domed churches of Aquitania. Decoratively, the influence was almost universal, for the goldsmith's work and carved ivories of Constantinople were distributed widely all over Europe. Occasionally, as in Tuscany, Pisa and Florence especially, the Roman influence was the most dominant.

By the last quarter of the 11th century, the development had reached a point where the builders' skill seemed at last adequate to the problem, and there occurred a rapid and exuberant flowering of architecture in Italy, France, Germany and Norman England that made the later birth of Gothic architecture inevitable. The climax period of Romanesque architecture was short, 1000 to 1150, because in the climax of the style were incorporated the seeds of the more perfect Gothic. In this development, the controlling idea was the vault. It was easy to vault the little spans of the church side aisles; but the problem of supporting and buttressing the higher vaults over the naves, and still allowing clerestory windows, was exceedingly difficult. Barrel and intersecting vaults were both tried; but the solution came only with the Lombard invention and the development of the com-

# ARCHITECTURE, HISTORY OF

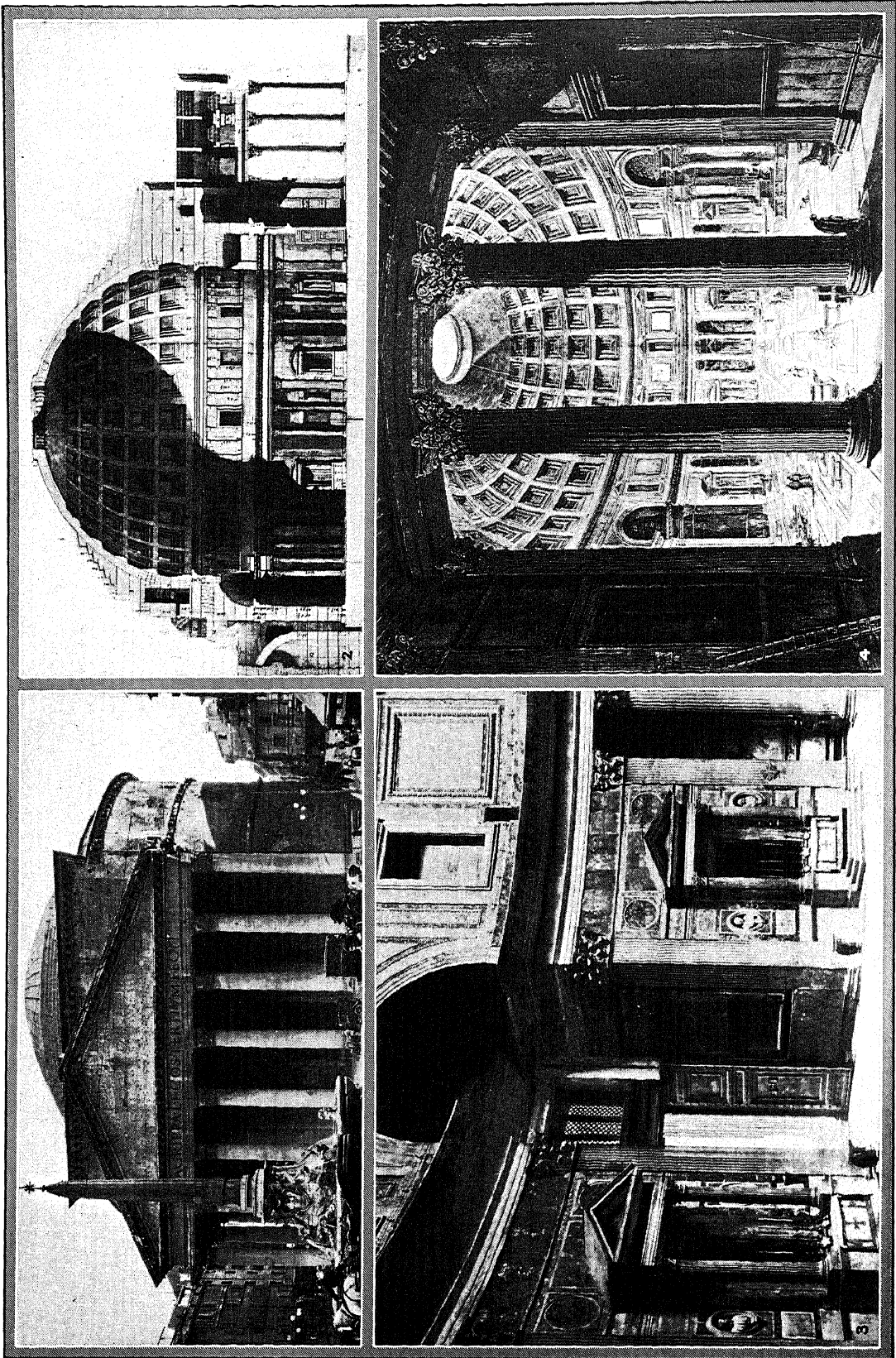


1, 2. COURTESY METROPOLITAN MUSEUM OF ART; 4. EWING GALLOWAY PHOTO

## CELEBRATED CITIES AND BUILDINGS OF THE ANCIENT GREEKS

1. Model of the principal buildings of Olympia, reconstructed as they were about 174 A.D. Center, the Temple of Zeus; center rear, the Temple of Hera. 2. Model of the Sacred Precinct of Delphi, 2nd century A.D. Center,

the Temple of Apollo; left background, the Theater. 3. Theater of Epidauros, once the most beautiful in Greece. 4. The Acropolis, Athens, surmounted by the ruins of the Parthenon and the Erechtheum.



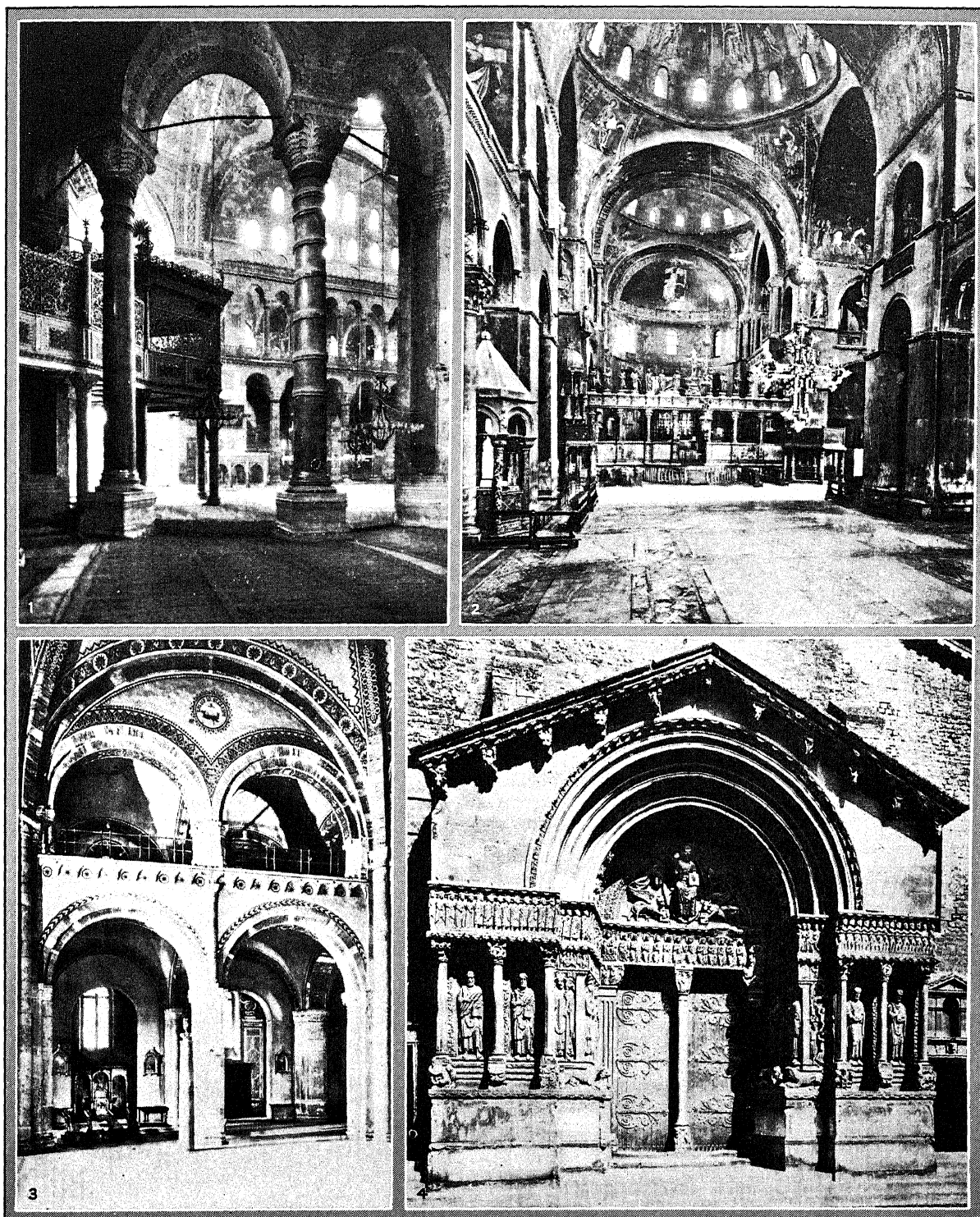
1. EWING GALLOWAY PHOTO; 2, 4. FROM ENGRAVINGS BY GIOVANNI BATTISTA PIRANESI (OPERA)

### THE PANTHEON AT ROME, ITALY

1. The ancient temple built by Hadrian about 115 A.D. as it stands to-day. 2. Transverse section, showing construction of the dome covering the temple. This, the greatest of all Roman domes, has a diameter of 144 ft. 3. Detail of the interior. 4. General view of the interior, lighted by an aperture in the center of the dome.



## ARCHITECTURE, HISTORY OF



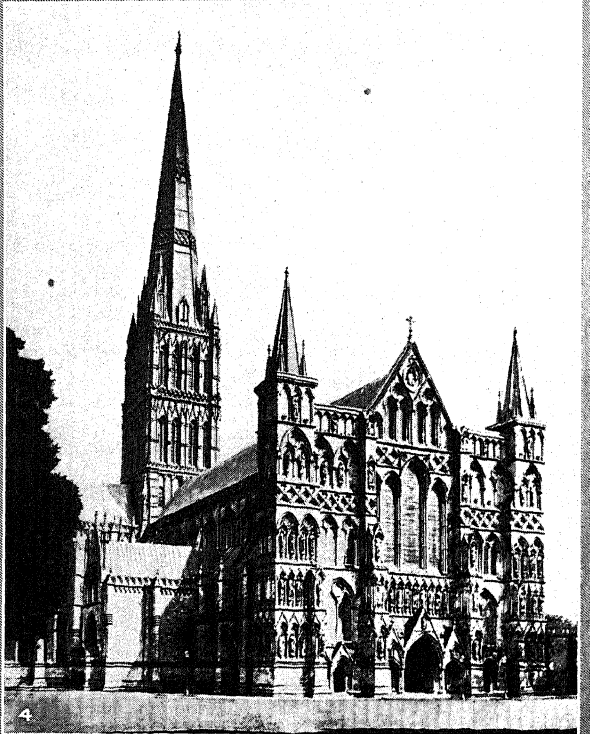
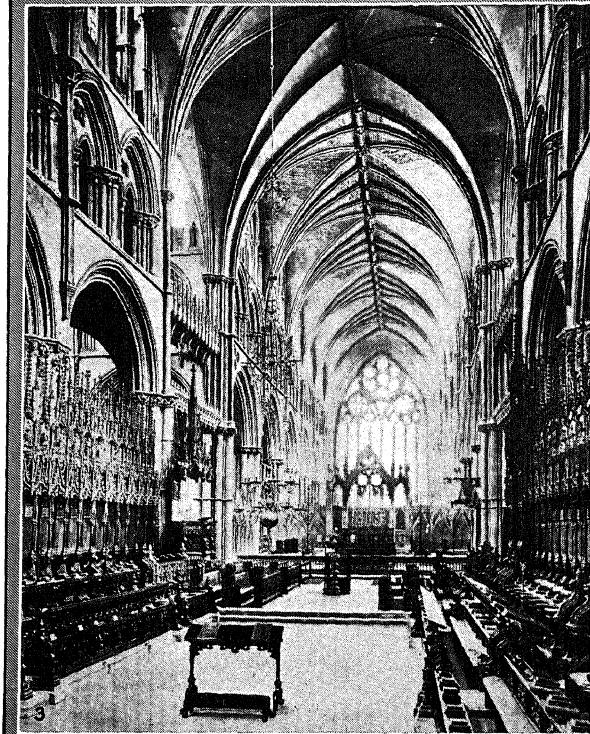
1, 2. PHOTOS BY PUBLISHERS' PHOTO SERVICE

### NOTABLE BYZANTINE AND ROMANESQUE CHURCHES OF EUROPE

1. Interior of the Church of St. Sophia, Constantinople. Byzantine 6th century. 2. Part of the interior of the Church of St. Mark, Venice. Byzantine 10th century. 3. Side chapels of the nave of the Romanesque basilica of

Sant' Ambrogio, Milan. 9th-10th centuries. 4. 12th century Romanesque portal of the Cathedral of St. Trophime, Arles, France, showing the rich sculpture and strong classic influence characteristic of the Romanesque of Provence.

## ARCHITECTURE, HISTORY OF



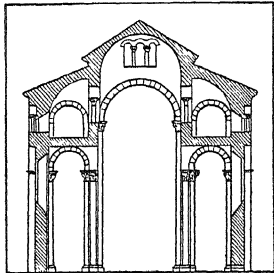
### CATHEDRALS OF ENGLAND AND FRANCE

1. Cathedral of Notre Dame, Amiens, France, showing the 13th and 15th century Gothic façade with its lofty portals and towers. 2. Nave of Amiens Cathedral, completed in

1236. 3. Looking east through the choir of Lincoln Cathedral, England. 13th century. 4. Salisbury Cathedral, England, built 1220-60, the spire later.

pound pier and the ribbed vault, and the development of adequate buttress systems in the Norman countries and in Burgundy.

Decoratively, Romanesque architecture underwent a similar growth, from the crudest carvings or mere scratches on the stone of the earliest Lombard work,



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SECTION OF NOTRE DAME DU PORT, CLERMONT-FERRAND, FRANCE

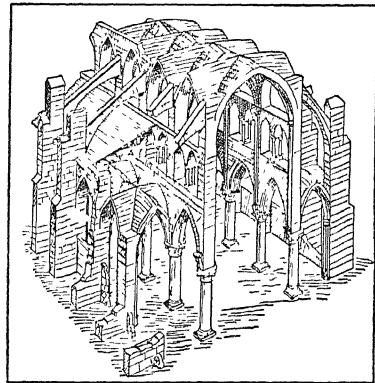
to the perfected sculptural skill of the 12th century. The thick walls which crude construction made traditional gave rise to the stepped arched portals; their colonnettes, moldings and tympana, or semicircles over the rectangular door openings, as well as the column capitals in cloister and church, furnished a perfect field for the sculptor. More and more individual skill asserted itself,

and the imitation of Roman and Byzantine things yielded to independent, rich and beautiful figure sculpture. Yet the inspiration of Rome can be traced again and again; and in the 12th century Romanesque work of Burgundy and Provence it is especially strong. In the decorative sculpture the grotesque element is everywhere present. It frequently expresses a savagery of conception, some strange pervading sadism and masochism, that is the result of an emotional instability of the times, expressed as well in such popular neurotic excesses as the famous children's crusade.

The Romanesque style was vivid, vital and powerful. Its ranked round arches, its rich carvings alive with religious passion, zest in life and sometimes with a terrible and tragic sense of sin and pain, its crude strong masses and low spreading vaults all combined to produce effects eloquent of the continual striving of mankind out of the chaos, crudity and cruelty of the Dark Ages, towards something more ordered, more gentle, more lovely.

**Gothic Architecture.** GOTHIC ARCHITECTURE is in essence the completed and logical solution of the problems already stated in the Romanesque period. The perfection of the system of ribbed vaulting was the first step; the second was the use of larger and larger windows to hold the decorative stained glass that in the 12th century was becoming more and more important in church design. The third and culminating step was the discovery of the enormous adaptability of the pointed arch. The pointed arch had been used spasmodically before in Romanesque, Byzantine and some Arabic work, but had never been a dominant structural factor. Its use solved one of the most common difficulties of the builders of ribbed vaulting, that of the varying heights of round arches of different widths. For instance, in a ribbed nave vault of round section, the diagonal ribs had to be flat ellipses. If round they would have caused the ridge of the vault to rise sharply from the cross ribs

up to the intersection of the higher, because longer, diagonal rib arches. When the vaulting bay or area between four piers holding one section was oblong, or the area was irregular, as in the vaults of the ambulatories around the apses of the churches, the problem of the round arched ribbed vault created almost insuperable difficulties. But with the adoption of the pointed arch as a controlling form these difficulties disappeared. It was possible to make arches of various widths with approximately the same height.



A. D. F. HAMLIN A HISTORY OF ARCHITECTURE. LONGMANS, GREEN

CONSTRUCTIVE SYSTEM OF A GOTHIC CHURCH, ILLUSTRATING PRINCIPLES OF ISOLATED SUPPORTS AND BUTTRESSING

Also in the pointed arch each half was in a sense an independent entity, so that in bays of irregular plan the apex of the vault, where the diagonal ribs came together, could be placed anywhere that appearance dictated, and yet the whole would be stable.

The second great discovery that enabled the development of Gothic architecture was the FLYING BUTTRESS. One great trouble the Romanesque architects had was in furnishing proper abutment to prevent the high nave vaults from spreading out and so collapsing. The flying buttress enabled nave vaults at last to be raised as high as was desirable, and it lightened and simplified construction. In the later Gothic churches, the spaces between the buttresses were sometimes enclosed and served as additional chapels.

Gothic architecture was first used in any complete way in the Abbey of St. Denis, near Paris, by the Abbot Suger, about 1140, and from then on its development and spread were almost meteoric in swiftness. The building of many great cathedrals in the second half of the 12th century and the first half of the 13th, which symbolized the new importance of the secular clergy and the gradual dying out of pure feudalism and the rise of an urban bourgeoisie population, gave tremendous opportunities for the new style. Moreover, the Cistercian monasteries, under the influence of St. Bernard of Clairvaux, had reacted strongly against the usual lavishness of Romanesque ornament, and especially against the grotesque. They compensated for this by carrying on structural experiments, and their influence also helped the new style. The



lay architects of the cathedrals were more experimental than the clergy, because less bound by the monastic traditions. There was, too, at last some feeling of peace and security in ordinary life, and consequent great commercial and craft activity, so that there was ample wealth to expend in building. The style born in the Ile de France at St. Denis spread widely, and before the end of the 12th century not only was the current style of North France but had appeared likewise in England, and by 1200 in Germany as well. By 1250 it was the universal style of Europe, except in Russia and Italy, and by 1300 even Italy was ex-



CATHEDRAL OF NOTRE DAME, NOYON, FRANCE  
Nave, looking east, showing early Gothic architecture of the 12th and 13th centuries

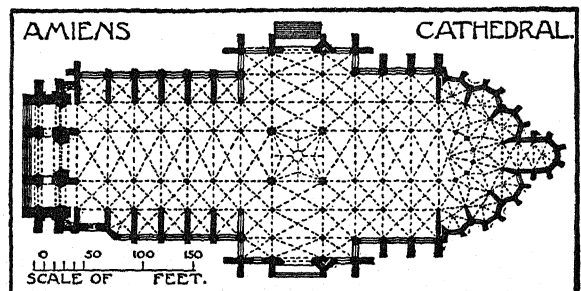
perimenting with local variations. As this style developed, it grew more and more logical, daring and skillful. Vaults were higher and higher, supporting piers more and more delicate, windows larger and larger. In many sections, especially in France and parts of Germany, the wall tended to disappear, or become a mere filler screen, an enclosure only, without value as a support. Developed Gothic structure was essentially a skeleton structure of slim piers and pointed arches.

An important secondary development of Gothic architecture was tracery. As windows grew in size, it became necessary to subdivide them, for the panels of stained, leaded glass, even with iron frames or armatures, could not be conveniently made very large. An early system of subdivision, known as plate tracery,

and best seen in Chartres, consisted of using two or three independent arched windows, or lights, side by side under one enclosing arch. The space between the small arches and the main enclosing arch was pierced with a large cusped round window or rose. If simple bars of stone are used to separate the lights and enframe the rose, and all the rest is left open, or filled with a pattern of stone bars in curved or arched shapes, bar tracery results. Used simply at the beginning of the 13th century, bar tracery grew more and more complicated. Cusping, the use of small, inward projecting forms made by the intersection of circular curves, was used more and more frequently. Lights were smaller, and the patterns above more complex. Elaborate rose windows were used at the ends of the nave and aisles. The forms that resulted were so lovely, that they were almost at once adopted as a purely decorative device. Tracery is used to ornament wall and buttress faces, gables, crests, railings, and even chests and other furniture.

Decoratively, Gothic architecture was characterized by a new birth in ornament as swift and important as that of its structural skill. It developed an ornament that was the natural result of its own forms: pinnacles to add weight to buttresses, gargoyles for water spouts, great porches set naturally between the projecting buttresses of the front. But its ideal was not stark, bare construction. Each of these basic forms became the field for carved ornament of great richness, charm and appropriateness, and, in France especially, of figure sculpture revealing the most perfect sense of the relation of architecture and sculpture which the world had known since the days of the Greeks.

The developed Gothic church had a nave and aisles, transepts and a choir with an ambulatory and chapels opening off it. Two aisles on each side are often found. The whole was brilliantly lighted by the side aisle windows below, and clerestory windows in the sides of the nave above the aisle roofs. Usually between the pier arches, separating the nave and aisles



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PLAN OF THE CATHEDRAL AT AMIENS, FRANCE

and the bottom of the clerestory windows, was a band of arcading known as a triforium. The ribs of the nave vault were apparently supported on vaulting shafts that ran down to the tops of the pier arch capitals, and sometimes to the floor, thus giving a tre-

mendous sense of height and lightness combined with strength. Only in England, where length was the dimension emphasized, was the horizontal range of the triforium arcade occasionally unbroken.

In France, Gothic development was continuous throughout the 13th century towards finer, more delicate, more logical forms; but the final result was often thin, wiredrawn and over-complicated. The 14th century, due to the 100 years' war with England, was less productive. But at the end of that century, and throughout the 15th and early 16th, there was a new flowering: the flamboyant style, characterized by flame and leaf forms in the tracery; fine scaled, intricate lacy ornament; small scale realistic sculpture, and many experiments in architectural form, such as the omission of capitals, the intersection of moldings, and the dying of richly molded arches and ribs into simple piers. In England, the development was from simple types, then the use of rich geometric tracery, next of tracery founded on wavy lines, and finally, the tremendous richness of the perpendicular work. Meanwhile, the English had been developing the ribbed vault in a way that was unique in Europe. First a ridge rib was introduced, then various intermediate ribs or tiercerons running from pier to ridge, then little intermediate tie ribs or liernes to make star patterns and net work patterns of the vault, enriched with carved bosses at the intersections. Finally, the fan vault was developed in which the ribs were so close together that to make them separate from the field became impractical. In the complete fan vault, the ribs are decorative only, and the vault is one continuous expanse of carefully cut masonry. Thus in England the fan vault, final climax of Gothic development, was in one sense a denial of the whole foundation of Gothic structure.

In Germany, French influence dominated, but in the 14th and 15th centuries a separate school grew up specializing in effects of extreme height and slowness, and later in open work spires and extravagant developments of tracery. Similarly in Spain, the earlier Gothic was largely under French influence. Later Germanic influence became important in detail; but the Spanish climate led to many differences in window sizes and the like, and Spanish taste never accepted wholeheartedly the slim long height of the north. In Italy, the Gothic ideal was never at home. Romanesque and even Roman traditions of building methods were too strong. Outside of a few abbey churches, and Milan Cathedral, largely planned and executed by Germans, Italian Gothic consisted largely in the mere use of the pointed arch, and the development of a lavish system of applied surface ornament using Gothic pinnacles, crockets and tracery in a most un-Gothic manner.

**Renaissance Architecture:** (See also RENAISSANCE ARCHITECTURE). The Roman tradition of decorative form had never completely perished in Italy. The Baptistery at Florence and the cathedral at Pisa show this persistence in the 11th and 12th centuries. The cloisters of St. Paul's Outside the Walls and of Sta.

Maria Maggiore in Rome reveal the same continuation in the 13th century. The sculpture of the Pisani shows evidence of a close study of Roman sarcophagi, just as the work of Dante is characterized by reflections of classical scholarship. During the 14th and early 15th centuries this interest in classic literature and classic art grew. The sudden emergence of a closer following of Roman detail in the work of Brunelleschi (1377-1446) and his followers was therefore no sudden break with current thought, but rather the simple expression of a cultural fact. The crossing of the cathedral at Florence had never been completed. In 1417 it was decided to hold a competition for an adequate and practical covering for the vast space. Brunelleschi, the winner, owed the grandeur of the spirit of his solution to the study of an inspiration of the great Roman vaults. Although his great octagonal dome with its ovoid pointed contours was perfectly harmonious with the Gothic style of the cathedral, it was nevertheless also the first architectural monument of the Italian Renaissance. The result of Brunelleschi's study of Roman remains shows its decorative results in his other, smaller work, especially the Pazzi Chapel, 1430, and the Arcade of the Foundling Hospital. The return to Roman architectural forms thus begun spread widely and rapidly. It was as if a people, long dreaming of foreign lands and striving unsuccessfully for alien ideals, had suddenly awakened to their true selves and their own special talents.

This awakening, moreover, came at a time when economic, social and intellectual forces were ideally fitted for it. The Italian towns with a flourishing citizenry, the great merchants' guilds, and the leading governing families were more and more developing an individualistic, restless, searching attitude towards life, and wealth was giving an opportunity for the amenities of life that somehow fell quite outside the categories of medieval thought or medieval architecture. The craftsmen's shops were turning out highly skilled painters, sculptors and metal workers; in the Early Renaissance at least, the greater number of architects were so trained. A civilization increasingly individualistic led to the growing importance of the individual designer or architect. That in turn led towards changing fashions, for the individual architect is given more scope for the exercise of originality, the expression of his own personality, than any designer under the binding ecclesiastical traditions of medieval life.

The early Renaissance in Italy, roughly from 1420-1500, is a style of charm and delicacy. It produced especially lovely things of small scale, like tombs, doors, windows, church furniture and similar details. It adopted and adapted all the principal Roman decorative details, such as the acanthus, the anthemion, garlands, cherubs, flying ribbons and the typical molding ornaments, and added some of its own, such as the shield or cartouche, the baluster and the semi-circular arched Florentine pediment, and then used them all freely, inventively, working out continuously new and lovely decorative forms. Yet with few ex-

ceptions, the Early Renaissance dealt little with large scale architectural invention. It developed, systematized and formalized the existing Gothic city house or palace forms, producing beautiful arcaded courts and loggias; but except in such rare work as the dome of the Cathedral of Florence and Alberti's San Andrea at Mantua, 1432-82, there is little monumental inventiveness evident. That was reserved for the following century, in the High Renaissance, that had its center in Rome, as the Early Renaissance had its center in Florence.

The classic monumentality of the High Renaissance was an inevitable reaction against the lavishness and the sometimes cloying sweetness of the Early Renaissance. Architects began to think in large conceptions, rather than details. The Roman orders, Doric, Ionic, Corinthian, were used with greater and greater freedom. Architectural carving was restrained, almost austere, but studied to the last degree of precise and refined suitability to its use. Effects depended more

and more on careful composition and basic greatness of conception, and less and less on detail. The High Renaissance appreciated and admired Roman grandeur as the earlier Renaissance had loved the delicacies of Roman ornament. A great richness of painted interior decoration accompanied this new conception. The earlier parts of the Vatican were characteristic of this quietness of architecture and richness of wall and ceiling color.

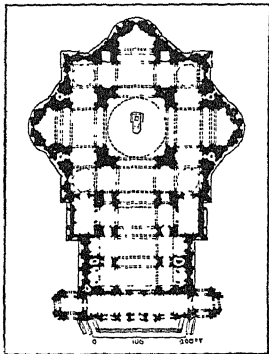
Some of the greatest of the Renaissance architects, especially Raphael (1483-1520), Peruzzi (1481-1536) and Michelangelo (1475-1564), were painters as well. Yet the best works of the period were great primarily because of the simplicity, the nobility, and the impressive magnitude of their architectural conception.

The Baroque development in architecture was a protest against the coldness and the academic quality that was the danger of High Renaissance work in the hands of architects who were not great. The Baroque designers felt their scope limited by the academic ideal. Bigness of conception, to them, required an utter freedom and fluidity of forms for its adequate expression. Roman architectural details no longer could suffice for the expression of their racing creative minds. Michelangelo's work again and again reveals a search for original, personal architectural treatments, and his last designs were entirely Baroque. Those who came after merely followed his lead. Baroque architecture was searching always for grandeur, great scale, dramatic contrasts and interesting line. The matter of the structural expressiveness of detail was forgotten, provided the plan was creative

and big, and the effect compelling and interesting. This insistence on effect occasionally led to mistakes in taste; interesting line became contorted, confused line, and great scale sometimes degenerated into mere vulgarity. Yet the quality of creative imagination is almost universal, and the glowing vitality of the style a necessary antidote to the crystallized and static refinement of pure classicism.

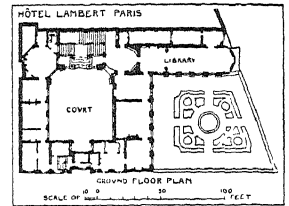
Renaissance architecture outside of Italy underwent the same general triple development: a decorative early style, a more classic later developed type, and then an experimental and lavish Baroque. Local conditions naturally affected the speed of the progress and the quality of the styles.

Especially in France, England and Germany there was a local late Gothic architecture of exuberant vitality which gave definite characteristics to the local early Renaissance. In France the pressure towards the use of classic forms was great, due to the classic Italian enthusiasms of Francis I and his court; but in Germany, Flanders and England no such factor existed. In France, accordingly, the classic orders and ornaments were thoroughly appreciated, understood and domesticated. That is, they were used not as imitations of

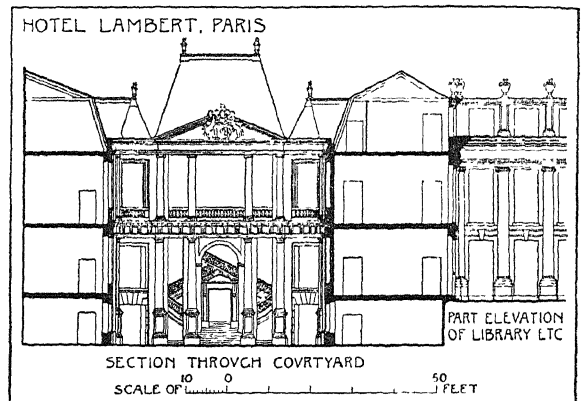


A. D. F. HAMLIN, A HISTORY OF ARCHITECTURE. LONGMANS GREEN

PLAN OF ST. PETER'S CHURCH, ROME, AS NOW STANDING



FROM F. M. SIMPSON, A HISTORY OF ARCHITECTURAL DEVELOPMENT. LONGMANS GREEN & CO.



FROM F. M. SIMPSON, A HISTORY OF ARCHITECTURAL DEVELOPMENT. LONGMANS GREEN & CO.

Italian work, but appropriately for the decoration of buildings still essentially French, by the middle of the 16th century in the reign of Henry II. Under the reign of Henry IV the Baroque influence asserted itself vigorously; but, like the early classicism of Henry II, it was adapted and appeared in a purely French guise. The architecture of Henry IV shows clearly the conflict caused by the double idealism of French Renaissance architecture, a trend towards classic purity, and an opposite trend towards Baroque fantasy and individual untrammelled invention. Under the influence of FRANCOIS MANSART during the reign of Louis XIII, the solution of this conflict was begun. Exteriors tended more and more to be con-

trolled by the classic influence, and interiors by the Baroque. This process continued unabated under Louis XIV to reach a climax in the quiet, purely classic exteriors and the rich fantastic, exuberant interiors current in the period of Louis XV.

In Germany and England, on the other hand, classic detail crept in slowly. Classic forms were not understood in the early Renaissance work, but used in all sorts of naïve ways in an architecture still basically Gothic. It was not until much later that the classic ideal was adopted, and then only when the Baroque movement was thoroughly established in Italy. Thus in Germany the Thirty Years' War was a definite break in architecture between earlier work entirely naïve and still largely Gothic, and later work entirely sophisticated and Baroque. Save in rare instances there is little that can be called High Renaissance. Similarly in England, Tudor and Jacobean work shows a blend, sometimes charming, sometimes awkward, between Gothic ideas and half understood classic detail. Only with INIGO JONES (1573-1652) in the 17th century did classicism achieve any complete English expression, and even that did not become the controlling English style until after the Restoration in 1660. This English classicism was under late Italian influence; but the inspiration was the polished restrained classicism of PALLADIO, not the exuberant Baroque of Rome. With this inspiration as a basis, Inigo Jones and later WREN (1632-1723) and his followers developed a thoroughly English but thoroughly classical architecture which had a marked effect upon America through the buildings of the American colonies.

In Spain the parallel to the Italian development was closer. Yet even there the High Renaissance (Griego-Romano) was of less importance and served largely as a mere break between the delicate, decorative lavishness of the early Renaissance, which showed many influences from both late Gothic and Moorish work, and the equally exuberant Spanish Baroque, which in its later forms known as Churrigueresque was extraordinarily productive and was the controlling style in most of the important Spanish buildings in Spanish America.

**Modern Architecture:** (See also MODERN ARCHITECTURE). The last two decades of the 18th century witnessed a complete break in architectural tradition almost everywhere in Europe and America. Two elements combined to bring this about: first, the development of a scientific archaeology that opened to the designers of the world a sudden flood of new accurate knowledge of the actual appearance of Roman and Greek buildings; and second, great changes in political and economic conditions expressed alike in the French Revolution, the American Revolution and the adventures of Napoleon. The end of Renaissance architecture was thus but one symptom of the decay of the entire Renaissance and medieval conception of life. To these factors, another was added. The discovery of the possible applications of steam power to industrial use opened the way for that surprising de-

velopment of the factory system, and its accompaniments, known as the industrial revolution. This rendered impossible the continuance of the old conservative aristocratic culture and the inborn conservatism of a prosperous peasantry. Other elements in the population came to dominate affairs, with new ideals and new needs. And the new productivity of industry produced wealth which made the new system flourish, despite the riots and misery caused by the period of readjustment. Modern architecture was the expression of this new life.

**The Classic Revivals.** To many revolutionists of the late 18th century, the Republican and early imperial eras of Rome seemed a veritable golden age. The dignity and sense of form expressed in Roman writings, as well as the ordered magnificence of Roman architecture, exerted an invincible appeal. To these men the last phases of Renaissance architecture seemed frivolous and unworthy. Thomas Jefferson in America criticized the colonial work of his time, as either barren and barnlike, or cluttered with inappropriate detail. Thus it was only natural for him to turn back to Roman work for his inspiration, as he did first in the Virginia State Capitol. Napoleon capitalized this popular Roman enthusiasm in his court, laws and buildings. Everywhere in France and America, in Russia, and occasionally in England and Germany, architects were designing either in direct imitation of Roman remains, or as they imagined the Romans would have done. The result was the Roman Revival, with its domed buildings, its triumphal arches, its great colonnades. See ROMAN REVIVAL STYLE.

As early as the 1750's the English literati had been interested in Greek archaeology. The result was the great work of Stuart and Revett, *Antiquities of Athens* (1762-1830), followed later by the Dilettanti Society's *Antiquities of Ionia* (1797-1915), covering the Greek work of Asia Minor. The refinement, the delicacies, the perfections of Greek detail thus made accessible could not fail to be appreciated; they made a Greek Revival (see GREEK REVIVAL STYLE) inevitable. The Greek Revival was the governing style in England and Germany during the 1820's and 1830's and exercised an enormous influence on current work in America. In France the Roman ideal was still strongly alive, and the keen French analytical mind saw at once the inherent difficulties in applying Greek details to modern buildings. The result was the style known as Néo-Grec, of the 1840's and 1850's, in which the architects, instead of using Greek archaeological forms, attempted to design for new conditions in what they felt was the Greek spirit, that is, with frankness, freedom, restraint and delicacy. It was a style of great promise, but its results were in general too personal for popular acceptance. The Néo-Grec school was inevitably a house divided against itself.

Except for the Néo-Grec style and various spasmodic attempts elsewhere, the classic revivals, both Greek and Roman, were founded on a fundamental fallacy. They identified archaeological correctness

with beauty, and the details of ornament with architecture. Thus the practical requirements of modern buildings caused them endless trouble and became things to hide or gloss over, rather than opportunities for new beauty. Windows did not fit into the Greek scheme of things, for instance. The result was an effort to hide them, or make them smaller. It is characteristic of the style that one of its most impressive and successful decorative achievements, the colonnade of the British Museum in London, by Smirke (1781-1867), should be a positive detriment to the building behind it. The Greek Revival was most successful in Germany and America and in those buildings, like many wooden American country houses or like Schinkel's great Berlin Theatre, where there was the least attempt to make the whole building ancient, the Greek detail being reserved for decorative embellishments.

Even in the matter of detail, the Revivals were doomed. Little was popularly known of the brilliant color of Greek architecture, and the importance of the sculpture that always accompanied it was not realized. Moreover, such sculpture could not have been imitated, for the sculpture of the time was almost at its lowest point of degradation. Thus two of the important factors in the effect of ancient Greek buildings were neglected, and the result was bound to be cold, gray or white, harsh and sometimes forbidding.

**The Medieval Revival.** By the '40s, the romantic movement in literature of the beginning of the 19th century had come to dominate popular thought. One of its characteristics was an interest in medieval life, in castles and knights, abbots and monasteries. In England the Oxford movement was a religious expression of the same medieval enthusiasm. Architecturally it felt that only a medieval Christian or Gothic architecture could express adequately a Christian civilization. The 18th century, especially in England, had witnessed spasmodic attempts to use Gothic forms, reaching a climax in Horace Walpole's house at Strawberry Hill, 1753-78. By the beginning of the 19th century, there was quite a fashionable movement towards the building of Gothic castles, absurdly picturesque. To this growing fashion, equally evident in some of the work of Schinkel in Germany, the Oxford movement gave definite intellectual prestige, and through the work of the Pugins (Augustus, 1762-1832; Augustus W., 1812-52), an adequate archaeological foundation. A widespread Gothic revival throughout the western world followed naturally, especially in church design.

There was one basic difference between the Classic and the Gothic revivals. The foundation of Gothic architecture is structural, and no study of the style could fail to show this. The two great architectural critics of the period, JOHN RUSKIN in England, and VIOLETT-LE-DUC in France, both realized this though in different ways. Ruskin tended to make his demands for architecture ethical, using words like truth, honesty, service and worship; Viollet-le-Duc was more scientific. The architectural re-

sults were different, as well. Through the thinking of Ruskin the Victorian Gothic developed, with its fantastic attempts to make Gothic detail expressive of truth and honesty, while in France the rationalism of Viollet-le-Duc led to a new emphasis on planning, structure and logic in the design of buildings in all styles. In America the English archaeological Gothic Revival, and the Ruskin-inspired Victorian Gothic were completely dominant.

**Renaissance Revivals and Eclecticism.** By the last quarter of the 19th century the Classic and Gothic revivals had been tried, run their course, and been proven wanting. A modern architecture could not be founded on an archaeological base. Thus the designers were forced to other inspirations, and the sense that they must use past forms as inspirations only, not as models. Naturally, they turned to their own Renaissance forms for this inspiration, and thus developed a sort of formal and eclectic classicism marked by a new synthesis of generally Renaissance materials. The freedom of this approach was a boon to the architects; at once the quality of planning, inventiveness of structure and freedom of detail increased. Eclecticism went further. Not only could Renaissance styles be so approached, but also the styles of Greece and Rome, or in ecclesiastic work, where the medieval Christian idealism of the Romantic revival still controlled, the Romanesque, Byzantine and Gothic. Continuous archaeological work, the enormous multiplication of books on architecture, and especially the use of the photograph as an illustrative medium had made the architect in a very real sense the heir of all the ages. The result was twofold: on the one hand, an enormous technical improvement in popular taste and a free-eclecticism that in its best results produced individual buildings of beauty, fitness and magnificence; on the other hand, in the work as a whole, a chaos of idealisms classic and medieval, which produced what was known as "the battle of the styles." This was the general state of architecture throughout Europe and America through the first decade of the 20th century.

**Twentieth Century Architecture.** In the 1850's and 1860's the structural use of iron for beams and supports was for the first time since Roman days developed so as to be practical. In France this was early recognized as a new architectural medium of great importance, and various attempts towards its frank architectural expression were made, for example, in the reading rooms of the National Library, and the Library of St. Geneviève, c. 1850. The London Crystal Palace, 1851, and later the Crystal Palace in New York, 1853, were even more creative in their use of iron and glass. Yet the strength of the classic tradition and the discovery of the fact that structural metal had to be covered with masonry in order to withstand fire, both combined to make these early attempts sterile. The American development of the elevator was as revolutionary as the structural use of iron and steel. Height in buildings became usable. Then, with the additional invention of the system

by which the outside walls as well as the floors and roof were carried on steel columns, the building of almost indefinite height was made possible. This created a tremendous number of new architectural problems, high office buildings, apartment houses, hotels and great shops.

Meanwhile another movement towards fresh architectural treatments had developed. From the 1870's on there had been spasmodic attempts at new creation in the decorative arts. Tiffany in America and Whistler in his decorative work in England alike approached design from a creative attitude that cared little for styles or archaeology. In the '90s this movement had spread through Europe and, under the name of Art Nouveau, dominated much furniture design and metal and glass work, in Austria, Germany, Belgium and France. Its climax was reached in the Paris exposition of 1900, where the wavy lines, free balance, and often contorted shapes of this new art were everywhere present, even modifying the *néo-Baroque* of the exposition architecture. Art Nouveau was a protest against all that was academic; its supporters argued that it was the part of the designer and architect to create, not to copy. It was a vivid and exuberant style, but it had no definite critical background save a vague hatred of the past, and it had no structural or practical basis. An art needs more than protest for a foundation, and Art Nouveau little by little declined after 1900 to be at last absorbed in other larger movements. Three men stand out from the period, Louis Sullivan (1856-1924), and later Frank Lloyd Wright (1869- ) in America, and Otto Wagner (d. 1916) in Austria. Sullivan was always seeking a newness in architecture, soundly based on the new problems and techniques. He influenced deeply a great deal of Chicago architecture, and the Monadnock Building by Roche, of Holabird and Roche, was perhaps the first successful attempt to realize the freedom, the air and light and verticality that steel construction made possible. In Vienna, Otto Wagner was similarly working towards an adequate, fresh expression of new problems and new materials. His influence, especially through his pupil Peter Behrens (b. 1868), was enormous.

In the pre-war years of the 20th century, America, save in a small number of cases, was completely under the sway of the eclectic classicism expressed with growing warmth and freshness in the Great World's Fairs at Chicago, 1893, St. Louis, 1907, and San Francisco, 1915. In Europe there was no such unanimity; particularly in Germany and Holland architecture was in an unsettled, enquiring state. It was natural, therefore, that the revolutionary work of Wright should receive European recognition while in America it was ignored, or even derided. Yet more even than in the case of Sullivan, Wright's work was founded on the architectural bed rock of needs, problems and materials, and approached always with a zestful and loving creative power.

**Post-War Architecture:** The break in natural development caused by the World War allowed an

evaluation and crystallization of the existing tendencies. Though the old traditionalism is dead as a controlling force almost everywhere, it is still often an inspiration. The structural problem of the great building is nearly solved, but its decorative expression is still a battlefield. The problem is no longer a battle of styles, between Classicist and Gothickist; it is a battle of important conflicting ideas, and no solution will be universally accepted until that battle is settled, if ever. On the one side are ranged those who believe in pure functionalism, like Walter Gropius in Germany, and Le Corbusier in France. To them, beauty or rather architecture, for some of them even deprecate the search for beauty, is the result of the simplest, most efficient and most starkly expressive solution. Ornament, art for art's sake, atmosphere, even character they claim are out of place in an honest architecture. On the other hand are those like Mendelsohn in Germany, who seek in a building to give it the most forceful, characteristic, essential forms, not mechanically, like the functionalists, but creatively, artistically. A third large group, particularly important in Scandinavia, Finland and the United States, is less theoretical, approaching architecture perhaps in a simpler way, but alert to questions of harmony with surroundings, to the spirit of a place or a country, as well as to the novelty of problems and materials. And lastly, there are still the stylists, who continue to feel the control of a set style; there are even modernist stylists, who design by using the creations of real designers as unthinkingly, slavishly and stupidly as in the past they used Gothic or Georgian.

Too great an emphasis is usually given the skyscraper and commercial building. As the symbol of the conquest of a new system of building, and the use of complex but integrated mechanical equipment, it is important. But as a great creative architectural movement, skyscraper design is too precariously founded. Great architecture must be the expression of great social idealism, or basic human needs, and the civilization that has given birth to skyscrapers does not know yet what its needs are, or what are the ideals it worships. Congestion, artificial inflation of land values, high or concentrated buildings, more congestion and inflation form a vicious circle that is in its various ramifications visible in all industrial cities, abroad and at home. Light, air and the green of trees and grass are becoming more and more luxuries. Beautiful buildings are torn down ruthlessly because land values no longer permit them to be profitable.

The future of architecture, not only in America, but in Europe as well, is dependent in the long run on non-architectural factors. All the architect can do is to take the problems handed to him by a type of life determined by governments, industrialists and financiers, making of those problems the most beautiful buildings he can, mitigating their evils by cleverness of planning. He can be, and often is, a leader in pointing out the dangers of such concentrated development; but he can never produce, with all our new materials and new equipment, buildings of essen-



tial greatness, to be inspirations to all who see them, unless they express an essentially great and inspiring type or kind of life.

T. F. H.

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**ARCHITECTURE, MODERN.** See MODERN ARCHITECTURE.

**ARCHITECTURE, PRACTICE OF.** This has developed gradually from the time of the Renaissance, and even earlier a modern type of professional architect sometimes occurred. Vitruvius's *De Architectura* gives much revealing information on the professional status of the architect of the Augustan age. The profession of architecture seems to be an inevitable result of a complicated civilization. In more primitive cultures the architect, engineer and builder were frequently the same person, as, for instance, in American Colonial days. But with growing complexity specialization became necessary. First, the architect became dissociated from the builder or contractor. With the 19th century development of competition in industry, it was more and more important to have the architect financially independent of the building process itself, in order that he might bring to bear upon the problem, both as creator and supervisor, an absolutely impartial and disinterested mind. This meant that he must be paid for his services only, regardless of profits from the actual construction. Similarly, with the enormous development of mechanical technique of building, a differentiation between the architect and engineer occurred. No one mind could adequately cope with all the elements in a modern building. The mathematics of structural steel and concrete, the question of the choice of standardized or special structural materials and methods, plumbing and heating and ventilating devices, elevators and electric equipment, these are but part of the things which must be integrated in a large modern building. Expert advice from specialists is desirable in all these things; therefore the functions of engineer and architect become necessarily more and more separated. In the ideal modern building the total is the result of many minds, with the architect as the controlling, organizing genius.

**Functions of Architect.** The architect usually works through an organization of designers, draftsmen, specification writers, engineers and others. The size of an architectural office, and the exact functions of its members vary so greatly, that in the ensuing description the term architect will be used for the organization as a whole. The architect's duties in regard to any building divide themselves into four stages: preliminary sketches, working drawings and specifications, the obtaining of estimates and letting of contracts, and the supervision of the actual construction. For specific details, see HOUSE PLANNING.

The architect should have a full knowledge not only of building costs, but of real estate conditions, rental values and running expenses. In many cases, the architect is expected to assist in the financing of the structure by helping to obtain the necessary mortgages or building loans. He thus often acts as general financial adviser to the project, and in some cases, in fact, is its initiator. This broadening of the architect's functions to cover such financial elements has often been disastrous. By focussing attention on matters that have no direct bearing on building beautiful buildings, it gives the false impression that the architect is a mere cog in the machine of profit making.

**Payment of the Architect.** The architect's fee varies according to the type and size of the building. In the United States it is based most frequently on the final total cost of the structure and varies from 12 to 15 per cent on alterations, interiors and furniture, or 10 per cent for small houses, down to 6 per cent on the usual schools or public buildings, and four, three, or even two per cent on large investment buildings with much repetition of details. The whole matter of the architect's fee for commercial buildings is in a state of flux and uncertainty. Much depends on what he is required to do. Sometimes he gives full services, sometimes he only prepares the architectural drawings, the engineering and superintendence being handled direct by the owners. Just as the construction work is handled more and more on a cost plus basis, so the system of paying the architect on some similar basis is growing popular. A typical arrangement is the payment to the architect of his office expenses, that is salary and overhead, plus a professional fee, either fixed as a definite sum or based on the office costs.

T. F. H.

**ARCHITRAVE, STYLES IN.** See BAROQUE; COLONIAL; CINQUECENTO; CURVILINEAR; DIRECTOIRE; EARLY CHRISTIAN; EARLY ENGLISH; EARLY REPUBLICAN; ELIZABETHAN; EMPIRE; FLAMBOYANT; GEOMETRIC; GEORGIAN; GOTHIC REVIVAL; GREEK REVIVAL; JACOBAN; LOMBARD; MUDEJAR; NORMAN; PERPENDICULAR; REGENCE; ROCOCO; ROMAN REVIVAL; TUDOR; VICTORIAN.



ARCHITRAVE

From the Palazzo Farnese, Rome

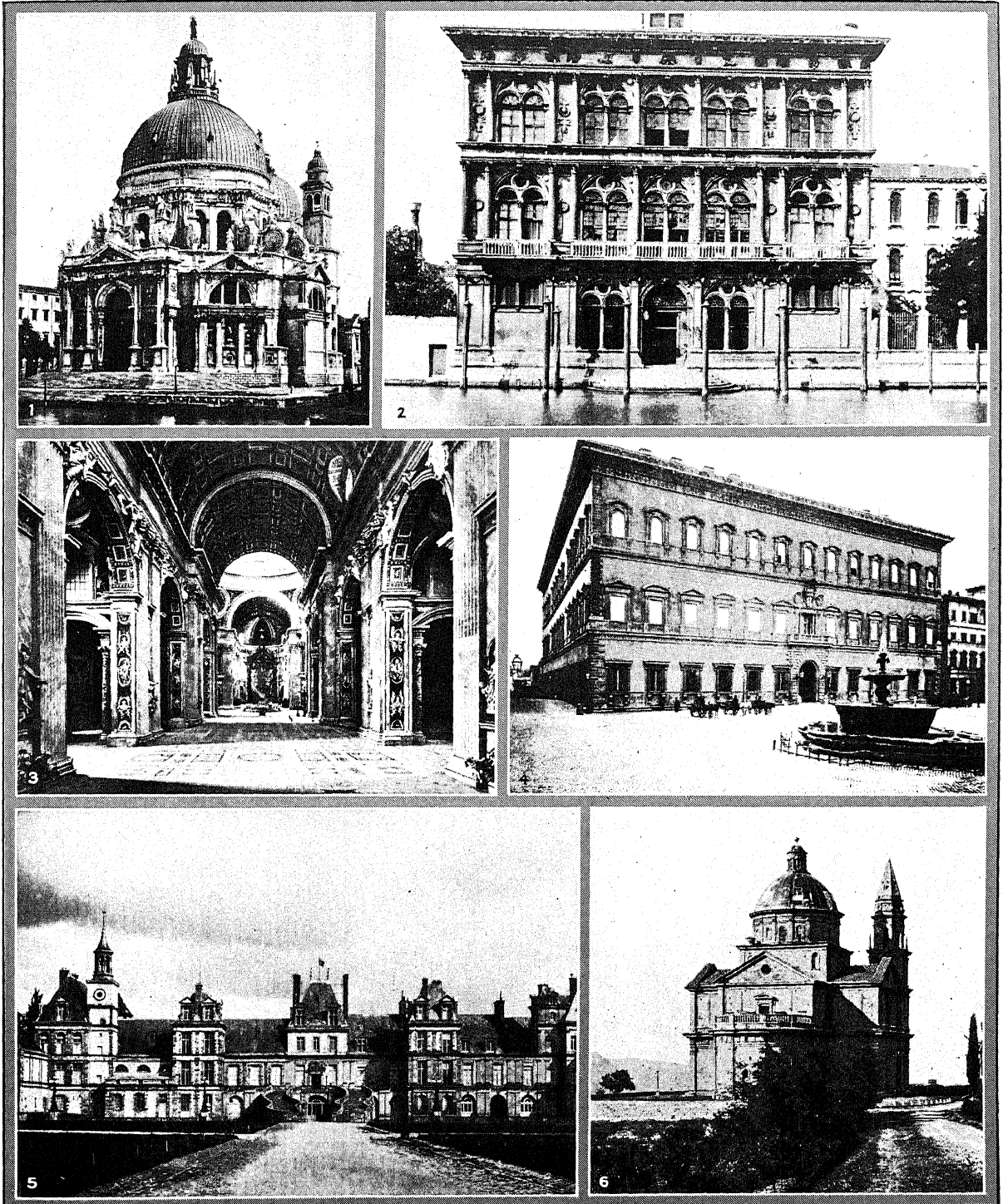
**ARCHITRAVE**, primarily, in classic and pre-classic architecture, the beam which was supported on the columns, and carried the crossbeams and roof rafters, thus forming the lowest portion of the classic entablature. For its varying forms, see ORDER. Bands similar in detail to this, and used to surround doors, windows or panels, are also called architraves.



ARCHIVOLT

**ARCHIVOLT**, a decorative molded band surrounding an arch, generally similar to an architrave in section and function. Archivolts of colored tile were used in Assyrian gateways in the 8th century B.C. The molded stone archivolt apparently appeared first in Etruscan work. Its use was common in Roman and Renaissance architecture.

# ARCHITECTURE, HISTORY OF

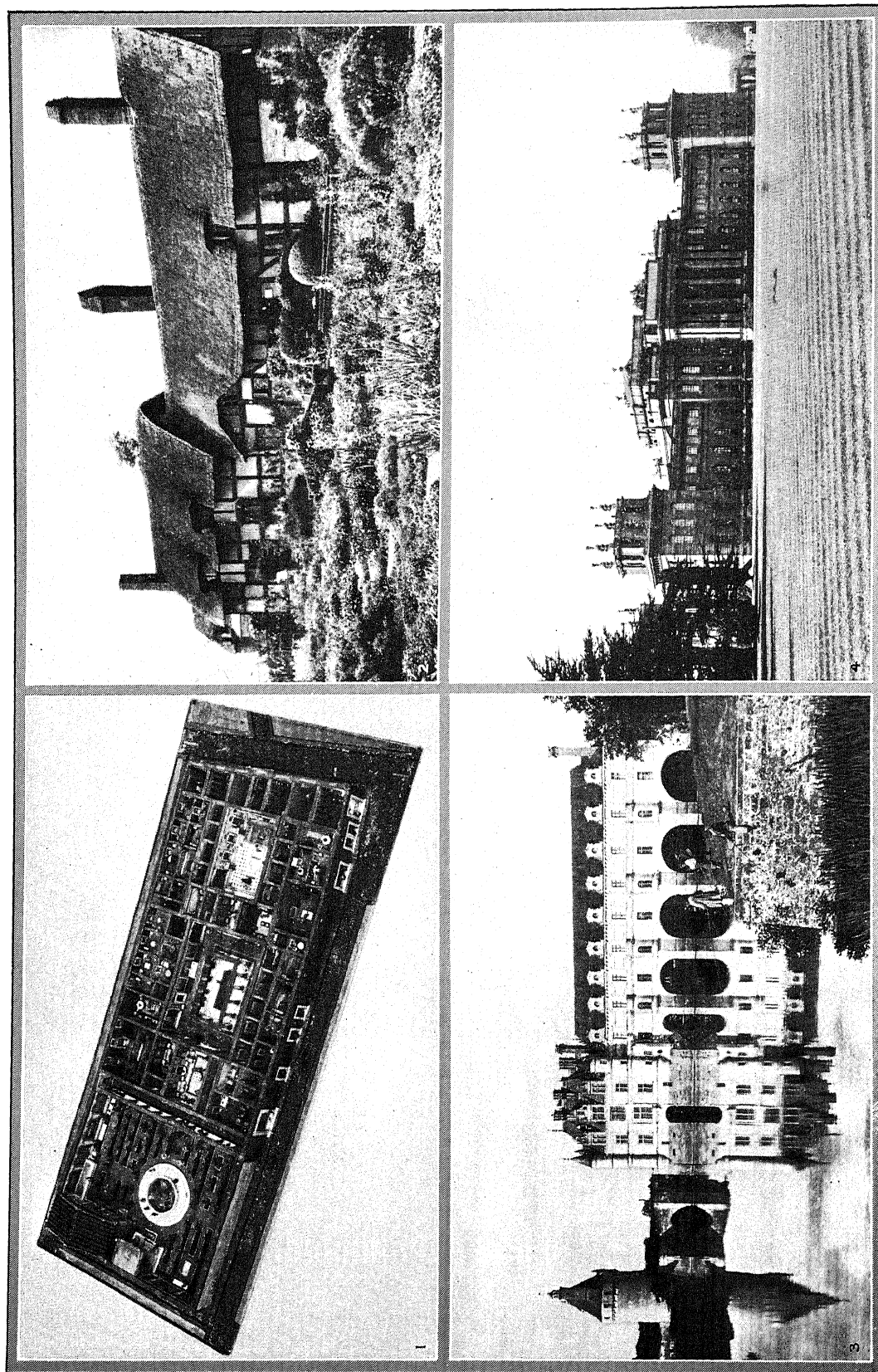


3. PHOTO BY PUBLISHERS' PHOTO SERVICE; 5. COURTESY FRENCH GOVERNMENT TOURIST INFORMATION BUREAU

## ARCHITECTURE OF THE FRENCH AND ITALIAN RENAISSANCE

1. Church of Santa Maria della Salute, Venice, 1631. B. Longhena, Architect. 2. Façade of the Palazzo Vendramini-Calergi, Venice, 1481. Pietro Lombardo, Architect. 3. Nave of the Church of St. Peter, Rome, 1560-1606. Michelangelo and C. Maderna, Architects. 4. Façade of the Pa-

lazzo Farnese, Rome, begun about 1530. A. da San Gallo the Younger and Michelangelo, Architects. 5. Palace of Fontainebleau, France, Henry IVth style. 6. Exterior of the Church of Madonna di San Biagio, Montepulciano, Italy, 1518-37. A. da San Gallo the Elder, Architect.

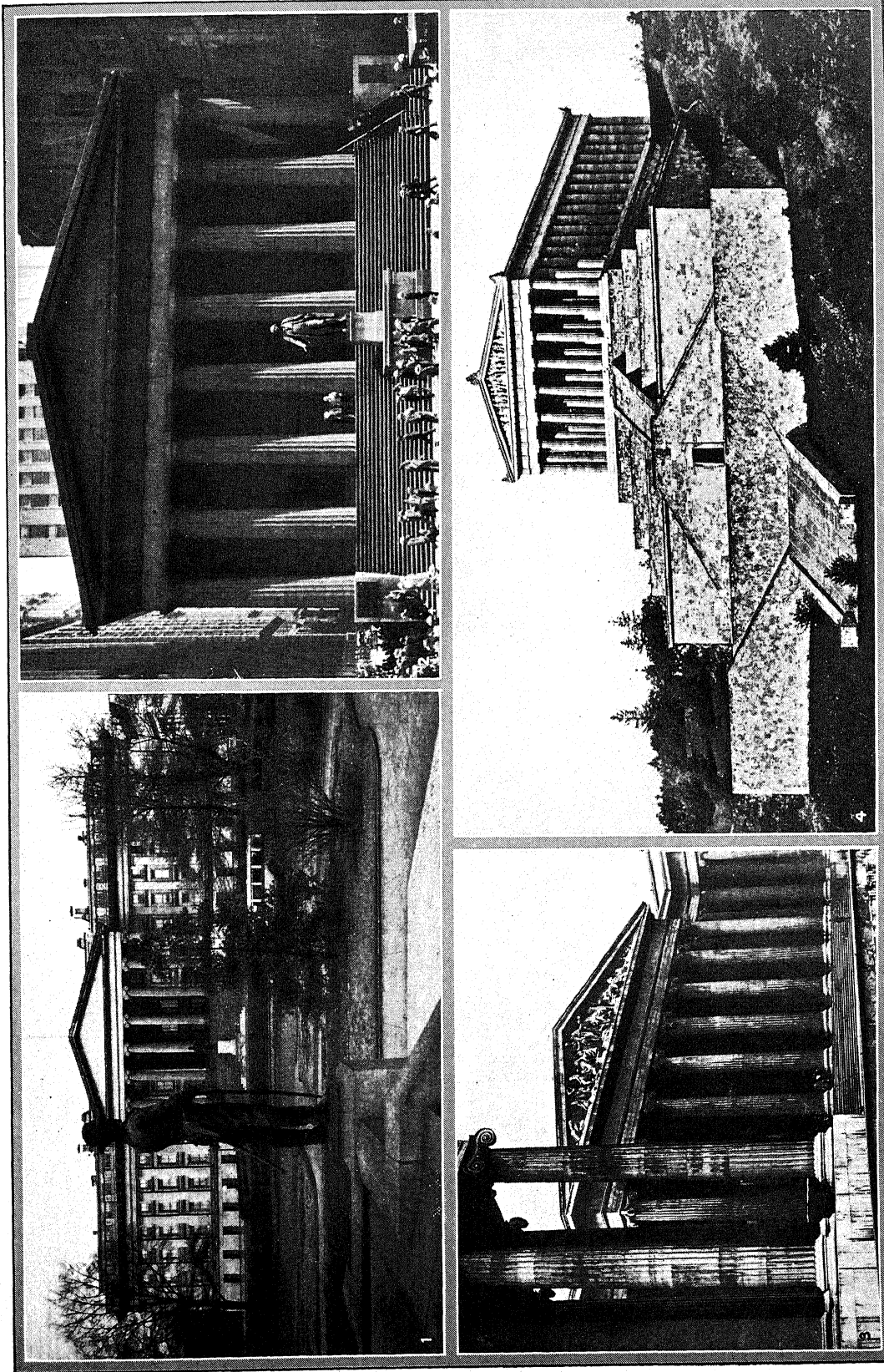


1, COURTESY METROPOLITAN MUSEUM OF ART; 2, PHOTO DE COU, FROM EWING GALLOWAY; 3, 4, EWING GALLOWAY PHOTOS

## DOMESTIC ARCHITECTURE IN ENGLAND, FRANCE AND ANCIENT ITALY

1. A restored model (with roof removed) of the House of Pansa, Pompeii. To the left, the garden with fountain; in the center, the peristyle court; and to the right, the atrium.
2. Anne Hathaway's cottage at Shottery, near Stratford-on-Avon, England, an example of Tudor half-timber work. 3. Chateau of Chenonceaux, France, founded 1515, an example of Francis I Renaissance architecture. 4. Blenheim Palace, residence of the Duke of Marlborough, England, early 18th century. Sir John Vanbrugh, Architect.



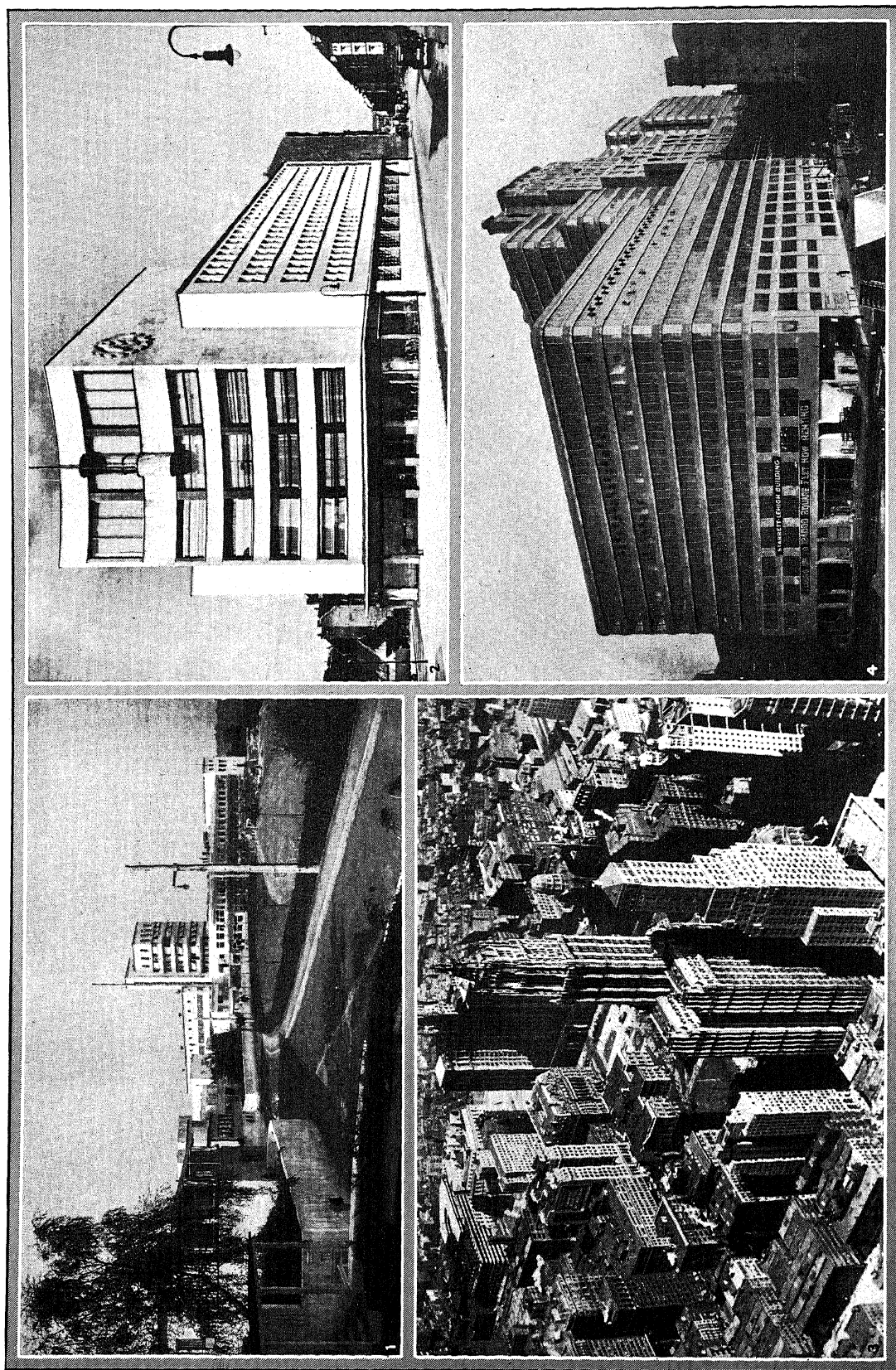


1, 2, PUBLISHERS' PHOTO SERVICE PHOTOS; 3, BY BURTON HOLMES, FROM EWING GALLOWAY; 4, EWING GALLOWAY

### THE GREEK REVIVAL IN MODERN ARCHITECTURE

1. Department of the Treasury Building, seen from the Sherman Memorial, Washington, D. C. Robert Mills, Architect. 2. Sub-Treasury Building, New York. Town and Davis and John Frazee, Architects. 3. British Museum, London, 1823-55. Sir Robert Smirke, Architect. 4. The Walhalla, the German Temple of Fame above the Danube, 1830-42. Leo von Klenze, Architect.

# ARCHITECTURE, HISTORY OF



1. COURTESY GERMAN TOURIST INFORMATION OFFICE; 2. ORIENT AND OCCIDENT PHOTO; 3. EWING GALLOWAY PHOTO; 4. WENDELL MCGRAE FROM R. I. NESMITH AND ASSOCIATES

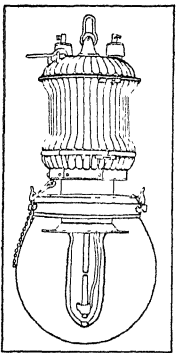
## TWENTIETH CENTURY CONSTRUCTION IN HOME, CLUB, OFFICE BUILDING AND WAREHOUSE

1. Weissenhof residential development in the suburbs of Stuttgart, Germany, 1927. 2. Metal Workers' Union Building, Berlin. Erich Mendelsohn, Architect.
3. Tower of the Woolworth Building, New York. Cass Gilbert, Architect.
4. Starrett-Lehigh Building, New York, 1932. R. G. and W. M. Cory, Architects.

**ARCHON**, chief magistrate of most Greek cities. At Athens the nine archons were elected annually; the first archon, called *eponymus*, gave his name to the year and dealt with private laws in slavery, divorce, insanity, etc.; the second, or king archon, dealt with religious matters—impiety, homicide, games, etc.; and the pole-march, who before the 5th century commanded all the military and naval forces, was later charged with military ceremonies, cases against foreigners in court, etc. The remaining six dealt with the laws pertaining to treason, counterfeiting and the like.

**ARCHPRIEST**, a priest who, in the early development of the Church, administered a mother church on which depended several villages.

**ARC LAMPS**, essentially, two electrodes, usually carbon, connected to a suitable supply of electrical energy, and a mechanism whereby the electrodes can first be brought into contact to start the flow of current and then drawn apart to form the arc. They may be operated on either alternating or direct current of 80 volts or more. The arc was discovered in 1801 by SIR HUMPHRY DAVY and was the first form of electric lamp to be used for commercial lighting.



COURTESY WESTINGHOUSE  
LIGHTING INSTITUTE

ARC LAMP

When an arc between pure carbon electrodes is operated on direct current, about 85% of the visible light is emitted from the positive electrode, which becomes crater-shaped, a lesser portion by the negative electrode and almost none by the arc gases between. On alternating current, each electrode becomes alternately positive and negative so that neither of them reaches maximum brilliancy.

Improvements in arc lamps have been effected by enclosing the arc in a glass globe; the impregnation of the carbon electrodes with chemical salts; and by using other materials for the electrodes. The smallness of the light source and its high intensity make the electric arc admirably suited for projection purposes. See LIGHT PROJECTION.

H. S. B.

**ARCO**, a term used in orchestral music indicating that the bow is to be used in playing a stringed instrument, such as the violin, cancelling the term pizzicato which directs the performer to pinch or pluck the string instead of bowing it.

**ARCTIC CIRCLE**, the parallel on earth that forms the boundary of the polar zone, inside of which on certain days the sun does not rise at all; on others it does not set. See MIDNIGHT SUN.

**ARCTIC OCEAN**, a large body of water covering the northern extremity of the globe, almost inclosed by Siberia, Alaska, the Canadian Archipelago, Greenland, Spitzbergen and Franz Josef Land, which are its land boundaries. Between Labrador and Greenland its water boundary is 59° 47' N. lat., separating it from the Atlantic Ocean. North of this

parallel the Arctic includes Baffin Bay, Davis Strait and Hudson Bay. Between Greenland and Siberia its limits are: the northern boundaries of the Greenland and Barents seas which approximate 80° N. lat. as far as Franz Josef Land; the eastern limit of the Barents Sea which is 60° E. long. to Nova Zembla, and from there the east limit of the Kara Sea. Between Siberia and Alaska the arctic circle separates it from the Bering Sea. Its area is estimated at 5,500,000 sq. mi. and its average depth at 3,950 ft. The maximum depth is 18,400 ft.

Off the shores of the surrounding continents are numerous islands, principally Wrangel, New Siberia, Baffin and others of the Canadian archipelago, but aside from these the ocean is a vast, monotonous plain of shifting, grinding ice sheets. During the summer months the edges of the sheet break and large floes drift southward into adjoining waters.

Along the arctic coasts the continental shelf or grade, between the land and deep sea, is of considerable extent, especially off Siberia where a depth of 100 fathoms is not reached before 300 to 400 mi. The salinity of the water is less than 30, whereas that of the Atlantic and Pacific approaches 36. The ocean's chief tributaries are the Nelson and Mackenzie from North America and the Lena, Yenisei and Ob from Siberia.

The Arctic Ocean supports an extensive marine fauna, chiefly seals, polar bears and whales. On its shores the Eskimos are the only permanent population.

**ARCTIC PLANTS**, a large group of botanically unrelated plants which tolerate the extreme conditions of the region of perpetual ice. Almost no trees except a few very stunted specimens of birches and spruce can stand arctic conditions, and, among shrubs, blueberries, willows and heaths are most plentiful. Practically all arctic plants are perennial, often woody, herbs, some of which grow in dense cushions. Many of these herbs have beautifully colored flowers, especially among the saxifrages, pinks, primroses, gentians, bellflowers, and plants of the daisy family.

Arctic plants are usually thick-skinned and may often be covered with thick coats of hair, their leaves are reduced in area and they have other modifications of structure to fit them for the climate. Nearly all these tend to reduce transpiration, because there is usually a deficiency of water. Living with their roots just above the tundra ice, and having a growing season of only about 50-60 days, arctic plants make heavy demands upon their roots for water. Add to this the almost continuous sunlight of their brief summer, and the physiological activities of arctic plants are naturally hurried. Desiccation, rather than extreme cold from which they are protected by winter dormancy, seems to be the leading factor in the occurrence and activities of arctic plants. See ALPINE PLANTS; TUNDRA.

N. T.

**ARCTURUS** (*Alpha Bootis*), the brightest star of that constellation and the third brightest star in the northern hemisphere. The Greek name signifies Bear-



ward, and was given to it because Arcturus follows the constellation of the Great Bear in the sky. It is a yellow giant star, 100 times brighter than the sun, and 30 times larger in diameter, 41 light years distant, and moving with a velocity of 85 miles per second. *See* STAR: *map*.

**ARDEN, FOREST OF**, the mythical forest setting of Shakespeare's *As You Like It*. An actual Arden Forest exists in Warwickshire, England.

**ARDMORE**, a city and the county seat of Carter Co. in southern Oklahoma, situated 98 mi. south of Oklahoma City. Bus lines and three railroads serve the city. There is an airport located here. Oil fields lie in the vicinity. Ardmore is surrounded by a rich agriculture region, producing cotton, corn, peanuts and other crops. In 1929 the various manufactures reached approximately \$1,500,000; the retail trade amounted to \$9,459,934. Platt National Park and the Arbuckle Mountains are just north of here. Ardmore was founded in 1887 and incorporated in 1898. Pop. 1920, 14,181; 1930, 15,741.

**ARDMORE**, located in eastern Pennsylvania about 8 mi. west of Philadelphia, is part of Lower Merion Township; it is on the Lincoln Highway and served by the Pennsylvania Railroad and the Philadelphia and Western Electric Railway and by motor bus lines. Ardmore is a residential suburb of Philadelphia and one of the fourteen communities included in the township, which is operated as a unit. The controlling board of commissioners has its township offices in Ardmore. Lower Merion Township was settled about 1714 by Welsh settlers, who named it for Merioneth in Wales. The post office in Ardmore was first known in 1853 as Cabinet Post Office. It was later renamed Athensville, and in 1874 the name was changed in honor of Ardmore, Ireland. Revolutionary landmarks are numerous. Valley Forge park, a state park, is 14 mi. distant. Pop. 1931 estimate, 20,000; about 11% were foreign-born and 8% colored.

**AREA**, the superficial extent of a limited surface measured in square units. For example, the area of a rectangle 10 inches long and 4 inches wide is 40 square inches. In Latin the word meant a vacant piece of land in a town. From the same word came the *are* (*ar*) of the metric system, the unit of measure of land. *See* MENSURATION; MEASURE, UNITS OF.

**ARENACEOUS**, a term used to indicate rocks composed of SAND, or containing sand, as arenaceous sediments, meaning sandy deposits. An arenaceous clay is one containing some SAND. *See also* ARGILLACEOUS.

**ARENDAL**, a port of Norway in the district of Nedenes, picturesquely situated at the mouth of the Nid on a bay opposite Tromø Island. It was formerly well-known for its magnetic iron ore mines, and is now famous for its shipbuilding. The town has a brisk trade, especially in lumber, and engages in shipping and fishing. The city was rebuilt in modern style after a fire in 1868. Pop. 1930, 10,403.

**AREOPAGITICA**, a pamphlet in the form of a speech to Parliament, defending an unlicensed press

and freedom of printing, written by JOHN MILTON and published in 1644.

**AREOPAGUS**, the highest court at Athens whose powers were changed from time to time. Composed of former ARCHONS, it had jurisdiction over cases of homicide, arson, wounding to kill, poisoning, starting a tyranny and other causes calling for the death penalty; it supervised public morals and public health; it might also veto the general assembly and admit foreigners to residence. After 461 B.C. it lost all but its judicial powers.

**AREQUIPA**, the second city in importance of Peru, 200 mi. south of Cuzco. In 16° 24' S. lat. 7,550 ft. above the sea, Arequipa, originally called Villa Hermosa, stands in a fertile oasis amid arid uplands, surrounded by great volcanic mountains, and is at the foot of the beautiful El Misti. The air is pure and dry and the climate delightful. The city has an oriental aspect; its massive houses are mostly of one story because of earthquakes. The houses are built of white stone, dazzling in the brilliant sunshine. The larger façades are adorned with elaborate ornament. With universities and cathedral, Arequipa has been for generations in the forefront of the literary and religious life of the nation.

Manufactures include cotton and woolen textiles, leather, tobacco and cigarettes; brewing and printing are carried on. Here also are the engineering shops of the Southern Railroad. There is an electric tramway service. Arequipa seems to have been a place of some consequence even in its earliest known days, for in 1553 it sheltered Giron, one of Pizarro's officers, who broke out into rebellion against him and collected a formidable army in the city. Est. pop., 1927, 70,000.

**ARES**, in Greek mythology, the god of war, identified with the Roman Mars. He was a son of Zeus. Ares represents the purely destructive elements in warfare, namely, slaughter, plague and the sack of cities. His temples were often built outside towns and were intended to ward off the approach of enemies.

**ARETHUSA**, a NYMPH or NEREID whose famous well was situated on the island of Ortygia near Syracuse. Alpheus, the river god, pursued her, and she was transformed into a spring of water which flowed under ground. A poem on Arethusa was written by Shelley, and the name is applied to a genus of Orchids in North America.

**ARETHUSA** (*A. bulbosa*), called also Indian pink and dragon's-mouth, a small orchid found in boggy places in the eastern United States and Canada, blossoming during May and June. Its smooth stem, 5 to 10 in. high, rising from a solid bulb, bears a single narrow leaf and a large, handsome, violet-scented, magenta-pink flower.

**ARETINO, PIETRO** (1492-1557), Italian satirical writer, was born at Arezzo, Apr. 20, 1492. He was banished from his birthplace for writing an objectionable sonnet and later attached himself to the court of Giovanni de' Medici. His last years were spent in Venice, where he wrote comedies and satir-

ical poems, and became a noted blackmailer. Aretino died at Venice, Oct. 21, 1557.

**AREZZO, GUIDO D'.** See GUIDO D'AREZZO.

**AREZZO**, a city of central Italy, capital of the province of the same name, on a hill rising from the valley of the Arno near a bend of the river. It is the seat of a bishop, and has fine educational facilities. Despite its advantageous position at the union of the valleys of the Arno and Chiana, which also merge into the upper valley of the Tiber, the city has lost its early importance. This is still attested, however, by the city walls, the Gothic cathedral, the remarkable Romanesque Church of S. Maria della Pieve, the palace of the Laymen's Fraternity, as well as other fine palaces, and valuable collections. As the trade center of a fertile region and the home of manufacturing plants of various sorts, it is again forging ahead. In ancient times Arezzo was *Arretium*, one of the most important old Etruscan cities. An independent republic after 1098, it lost the Battle of Campaldino, 1289, in which the youthful DANTE fought. In the 16th century it fell to Florence and remained under its control until 1860. Arezzo was the home of many famous men, among them MAECENAS, PETRARCH and ARETINO. Pop. 1931, 56,976.

**ARGALI** (*Ovis ammon*), the largest and finest of central Asian wild sheep, inhabiting the Altai Mountains. Full-grown rams stand as high as a large donkey. The massive coiled horns reach a maximum girth of 18-20 in., and a length round the curves of 59-62 in. In summer the pale brownish gray coat fades to almost white. The true argali are now apparently restricted to the Semipalatinsk district, south of Siberia; but they are represented by closely allied races in Tibet and Mongolia.

**ARGAND BURNER**, a lighting burner invented by Aimé Argand, of Geneva, in 1784. In its original form it was designed for burning oil from a tubular wick held between concentric cylinders. The draft from the air passing upward through the inner cylinder effected a great increase in illumination over the ordinary burner. It is said that the advantages of a steady flame and a stronger draft produced by adding a glass chimney were discovered accidentally by the inventor's younger brother. With the advent of the use of gas (see GAS LIGHTING), Murdoch adapted Argand's idea to the design of a gas burner; in it the gas issues from a number of orifices arranged in a circle, and the flame is enclosed in a glass chimney.

**ARGENTEUIL**, a residential and industrial suburb of Paris, situated on the Seine. The old town was built around a convent founded in the 7th century, famous as the retreat of Abélard's beloved, Héloïse. Argenteuil lies in fertile country, and holds a celebrated festival for the annual vintage. Pop. 1931, 70,657.

**ARGENTINA**, officially *Republica Argentina*, the second largest country of South America, extending from Bolivia 2,300 mi. to Cape Horn and from the ridge of the Andes to the South Atlantic, the greatest width being about 860 mi. It is bounded on the

north and northeast by Bolivia, Paraguay and Brazil, on the east by Uruguay and by the Atlantic Ocean, on the west by Chile and on the south by the converging lines of Chile and the Atlantic. Area 1,153,119 sq. mi. Pop. 1930, 11,192,702.

**Surface Features.** Argentina comprises six major geographical regions. These are the Argentine Mesopotamia, Chaco, the oases, arid plains and mountains of the west, Patagonia and the Pampa region.

The Mesopotamia region is the most abundantly watered area of the country. It is so named because of its location between the two great rivers, Paraná and Uruguay. From the swampy shores of the lower Paraná to its northeastern extension between Paraguay and Brazil, the region embraces 74,000 sq. mi. Fluvial deposits of clay, silt and sands cover the greater part. Running waters have formed the rolling landscape and carved out secondary valleys. A large part of the land supports a growth of grass similar to that of the Pampa, though far less continuous, owing to the strips of mimosa in the valleys. In certain places, tree growth expands into a solid forest. A much-dissected sandstone plateau rises progressively towards the northeast to an elevation of more than 2,500 ft.

The Gran Chaco of Argentina lies south of the Pilcomayo River. It is essentially a low-lying country of only slight elevation. Succeeding one another at varying intervals extend lands of scrubby brush, patches and strips of tall grasses, palm groves, true forests and swamps. Here are the valuable quebracho forests.

About one-fourth of the area of Argentina is comprised of the ranges and spurs of the Andes. From the level of the sea the land rises to the greatest heights of the continent, on the gigantic mass of Mt. Aconcagua and in northern Mendoza. In the northeast and the southeast broad plains dominate; in the middle the *monte*-covered Sierra de Cordoba, averaging over 5,000 ft., separates the region from the Pampa. Westward, by way of numerous outliers of the Andes, the surface rises rapidly to the towering ranges and snow-crowned peaks of the Andes. Most of the northeast has a flat surface with numerous swamps and a paucity of streams. For the larger part of the region there exists no drainage to the sea. Great salt plains abound in the west central portion. Over the confusion of plain, plateau and mountain, aridity prevails almost everywhere.

Located in the main on the extensive alluvial deposits composing the piedmont of the Andes and associated mountain masses, the group of oases of the interior from the Bolivian frontier to Patagonia has played a vital part in the rise of Argentina. To the west lie the arid, rugged bulks of the Andes; to the east stretch the waterless deserts, but at the points where the debouchment of Andean streams upon the plains has resulted in the building of alluvial cones and fans, the practicability of guiding water to fertile soils has led to the creation of rich agricultural districts.

Argentine Patagonia is the largest geographic division in the republic and has the smallest density of population. From its northern boundary zone, at the Colorado River to Cape Horn, it embraces more than 300,000 sq. mi. As a whole, the aspect is one of rugged territory, forest-clad in small parts in the west, steppe chiefly in the south, and barren, wind-swept expanses in many sections. In parts rising to more than 2,000 ft. above the sub-Andean zone to a total elevation of 5,000 ft., the series of plateaus of Patagonia extend eastward to the narrow coastal plains. Deeply incised valleys cut the uneven surface of the plateaus from west to east, but tributary systems are small because of the paucity of waters on the vast tracts of rock-débris on the sandstone and crystalline plateaus. Except for the lands of the far southern plains, the region is semi-arid to desert. In the northwest the rains of the Andes support a forest of pines. South of Lake Nahuel-Huapi, this gives way to a growth chiefly of Chilean beeches. At the margin of the forest extend grasslands.

The southern half of the Argentine plain is known as La Pampa, or "the plain." This particular Pampa occupies about 25% of the area of the republic. It is one of the most fertile areas in the world and is the heart of the Argentine nation. With a north-south length of 700 mi., it may be considered as extending from the Atlantic westward 400 mi. to the line of 16 in. of annual rainfall, beyond which level land still continues, but the country is semi-arid and is clothed with scrub. The Pampa proper is a featureless plain originally without a tree but now dotted with groves which have been planted to protect *estancia* buildings. The *estancia* is an estate devoted mainly to raising livestock.

**Rivers and Lakes.** The best known river of the republic is the RIO DE LA PLATA formed by the junction of two rivers no less important, the PARANÁ and the URUGUAY; and to this system belong the rivers Paraguay, Pilcomayo, Bermejo, Iguassu, Salado, Carcarana and all their respective tributaries. The principal rivers which cross the southern territories from the Andes to the Atlantic are the Colorado, Negro, Chubut, Deseado, Santa Cruz and Gallegos. The largest lake of the country is the beautiful Nahuel-Huapi in Patagonia, 2,100 ft. above sea level and 200 sq. mi. in area. Lake Buenos Aires is 550 ft. above the sea and is 75 mi. long.

**Climate.** The climate varies greatly in Argentina. The northern portion extends 100 mi. into the tropics; some small islands, far south of Cape Horn, lie within the south polar zone; but the great central plain lies in middle latitudes. In the Mesopotamia region, rainfall exceeds that of any other section of equal size in the country. Rains increase uniformly from less than 40 in. at the south to more than 60 in. at the northeast. In the northern lowlands, high temperature and humidity make living conditions unattractive, but the cooler lands of the south and those of highland *Misiones* enjoy a rather healthful climate. All central Patagonia receives less than 8 in. of pre-

cipitation per year. The rain falls only occasionally, and then in heavy showers; mild winters and cool, short summers prevail; southward, the lower Andes to the west and the tapering of the continent allow a free play of oceanic winds over the land, giving a cool, moist and windy climate with much less range of temperature than in the drier north. The plateau in Santa Cruz, which supports a large number of sheep, receives an annual precipitation of 10 to 20 in. In the south the winters are particularly rainy and disagreeable.

**Flora.** A most conspicuous plant found in Chaco is the wax palm (*Copernicia cerifera*), one of the 12 members of the palm family which grow in Argentina. More widespread is the *algarroba* (*Prosopis*), a kind of mimosa like the carob, which is of considerable economic value to the natives because an excellent beverage and flour are made from its fruit. The bread, somewhat like pounded chestnut, is very nutritious. This valuable tree also supplies excellent building material.

About 35% of the area of the republic is classed as forest land, but much of this is very thin, and probably not over half of the land so classed contains much merchantable timber. By far the most valuable are the *quebracho* forests of Chaco. This tree grows only where the annual rainfall is 25 in. or more and where the temperature is semi-tropical. In the region between the Paraná and Paraguay rivers, forests of considerable density arise. The trees are mainly hardwoods, but in the extreme north there is a great deal of Paraná pine, the most useful construction timber growing in this part of the continent. The region also contains the *yerba* groves. Along the Argentine slopes of the Andes of Patagonia are forests of possible future value but of small present worth because of their out-of-the-way location. Besides these forests, large areas of land are covered with *monte*. The greater part of the Argentine forest land is owned by private individuals and corporations. Native forests supply only a small fraction of the lumber used in the country.

The *quebracho* forests contain a variety of trees, but the *quebracho colorado* (*Schinopsis Lorentzii*) supplies the greater part of the lumber. The export of quebracho extract amounts to about 200,000 metric tons annually, and logs average about 150,000 tons.

**Fauna.** The Rio Negro forms to some extent a zoological parting line, as indicated by the two species of the rhea, or American ostrich, and of the jaguar, the smaller in both cases being confined to Patagonia, the larger ranging the northern regions. Peculiar to the extreme south are also two varieties of the wild cat. But the divide is crossed by the puma and guanaco, which range to the extremity of the continent. On the lagoons, countless flocks of all kinds of birds rise on the wing. These include wild duck of half a dozen species; sand-pipers and teal; bronze ibises, beautiful birds with glossy dark green and coppery plumage; innumerable herons and cranes; gorgeous flamingos; and the rare and lovely roseate

spoonbill. Of the mammals the most characteristic is the *vizcachá*, which corresponds to the North American prairie dog. There are few reptiles; the Jacare alligator scarcely exceeds 6 or 7 ft. in length.

**Agriculture.** Much of the land of the country is very fertile, and the climate of the Pampa is pleasant, but the agricultural methods are wasteful, as they are in many young countries. The yields of grain per acre average less than in the United States, and are from one-third to one-half as large as in France and Germany. This is due mainly to tenant farming. There is a shortage of farm labor. Land has been abundant and cheap, and there has been no intensive cultivation. Although not ranking with the United States, Canada or Russia, Argentina is one of the great potential food producers of the world.

In the Mesopotamia region the tillage of the land has slowly developed because of the gradual growth of population. Subsistence agriculture prevails. Crops include mandioca, peanuts, sugar cane and various fruits. Assisted by the wide distribution of yerba in its natural habitat, the establishment of plantations has progressed on a large scale; in 1929, the area in yerba maté was 82,000 acres, with a production of 45,000,000 lbs.; 15,000 laborers were employed. The efforts of the country to make itself independent of Brazil and Paraguay with respect to its large consumption of yerba maté promises an area of expansion for *Misiones* and the lands of Corrientes which produce the beverage.

The Chaco region can produce little for some time because of the small population, restricted market at the cattle *estancias*, poor transportation facilities and ports, and unfavorable natural conditions over vast areas. Augmenting the list of difficulties is the fact that nearly every year, from November to February, a plague of locusts arrives. The rapacious insects devour field crops, vegetables, young grasses and even the leaves of the trees. Often the plague arrives too late to do great damage to wheat and linseed. Alfalfa, always eaten to the ground, soon springs up again. Corn is ruined when the pest enters a field. Despite these several handicaps two zones of crop production have materialized. The earlier of these comprises a strip of some 20 mi. in width along the Paraná and the Paraguay, where the concentration of population has given rise to diverse cultures of sub-tropical as well as temperate crops. The second zone consists of an uninterrupted series of settlements along the government railway from Resistencia westward where cotton-growing bears promise of a new era. The cultivation of cotton on an important scale in the Chaco is of recent development and has been fostered greatly by the Argentine government. In 1929, the crop occupied 250,139 acres in the republic; of this Chaco had 210,000 acres.

The *bañados* along the Rio Salado and the Rio Dulce of the arid plains of the west make up a considerable acreage. The *bañados* consist of cultivated plots to which the waters of flooded streams are di-

rected. Corn is the chief crop, and wheat also does well.

The oases of northwestern Argentina, with sub-tropical climate, abundant waters and fertile soils, produce a variety of crops. In addition to sugar, which occupies half the cultivated area of 350,000 acres, and corn which grows on one-fourth of the land, the major crops are alfalfa and rice. Fruits and tobacco also furnish a large income, and pineapples prove especially profitable.

Sheep-grazing is the leading agricultural activity in Patagonia. While the south has areas with sufficient rainfall to permit the growth of crops, the low temperatures of summer make ripening impossible. Extensive production of crops becomes possible only in the less cool though more arid districts roughly in the area north of central Chubut. There is an important area of 70,000 acres at the headwaters of the Rio Chubut, settled by a group of Welsh farmers.

**Dairy Industry.** The dairy industry of the eastern districts of Buenos Aires has advanced notably in recent years. After meeting local requirements, the dairying districts exported butter in such quantities as to make it one of the major sources of that product in international trade, and are following up this advance by supplying the outside world with considerable amounts of cheese.

**Cattle and Meat.** Cattle-raising remained unimportant as long as the only exportable product was hides, but the establishment of the *frigoríficos*, or freezing works, revolutionized this by causing a great increase in the value of cattle suitable to the frozen meat trade. An enormous premium was thereby placed upon improved stock, and the native or *criollo* animals were rapidly graded up by means of the best meat-producing stock, such as Shorthorns and Herefords imported from Great Britain. Cattle-rearing in Argentina received a greater stimulus through the spread of alfalfa cultivation. In 1928 the packers bought 2,818,116 head of cattle, paying \$162,373,000. In 1929 the livestock in the country included 37,064,850 cattle, 36,208,981 sheep, 9,432,421 horses, 813,051 mules and asses, 4,819,835 goats and 1,436,638 swine.

The first meat regularly exported from Argentina was jerked beef. The first refrigerator ship docked at Buenos Aires in 1876 and initiated the shipment of frozen meat, chiefly mutton. By 1889, a million carcasses of frozen mutton were being exported yearly. During this period live cattle were being shipped to Europe to be slaughtered there. Later, the freezing plants prepared and shipped frozen beef as well as mutton; but not until 1901 did the shipping of chilled beef in quantities begin. The building of huge modern meat-packing plants by American and English companies has greatly changed the meat trade of Argentina. Frozen beef is still shipped in large quantities, but chilled beef has taken the lead. The exports of beef in 1928 totalled 515,846 metric tons; mutton, 18,000 metric tons.

**Grape and Wine Industry.** Although in season the consumption of fresh grapes is large, the bulk of

the crop goes for the manufacture of wine. The use of table grapes increases, especially for the export trade, and the Mendoza oasis has 17,000 acres producing this variety. Altogether Mendoza has 170,000 acres of grapes, San Juan 100,000 and San Rafael 35,000, in the aggregate 82% of the grape acreage in Argentina.

In 1929, wine production amounted to 143,091,872 gals. from 280,000 acres. There are 2,460 plants in the country capable of producing 150,000,000 gals. of wine. Of the total manufacture, the Mendoza-San Juan-San Rafael plants produce 96%. The wineries attain huge proportions; one has an annual capacity of more than 6,000,000 gals. Although these wineries or *bodegas* make high and low grade wines, the bulk of the output consists of a strong red wine. The per capita consumption approximates 14 gals. per year.

**Manufactures.** Industries other than those concerned with the milling of wheat and the preparation of meat in freezing works, are not as yet of much importance, though numerous articles of domestic consumption are made in Buenos Aires. In spite of its poverty in locally produced fuel, the country seems to be making a determined attempt by means of increased protective duties to encourage domestic manufactures. A large variety of minor industries operate for domestic needs. In addition to the production of animal and crop commodities, manufactures include cotton, wool, silk, metal work, leather, shoes, tobacco and brewery products. Owing to the concentration of population and transportation facilities the seaboard cities support the only important industries. There are upwards of 60,000 manufacturing establishments in Argentina giving employment to some 600,000 operatives.

**Minerals.** The lack of important coal resources in Argentina is a serious handicap. The only important petroleum fields are near the coast in Patagonia, 900 mi. south of Buenos Aires and in the northern province of Salta. Production at the Comodoro Rivadavia field dates only from the early years of the 20th century, when men drilling for water for their flocks in the coastal desert struck a heavy oil of excellent quality. With the assumption of control by the government, the aspect of the barren coast changed. In a waste of sand, oil-derricks soon arose, and Comodoro Rivadavia has grown to a community of more than 5,000 people. Though the annual production of 9,391,000 gals. in 1929 does not fill much more than a third of Argentine requirements, the field is an important source of fuels for the country. Tungsten deposits yielding 8 to 10% of the world's supply are worked in the north central part of the country. Unimportant quantities of gold, silver, copper, lead and zinc have been mined in the mountains of the west, but the difficulties of transportation and the long distance from the principal markets do not make these operations profitable. Small quantities of salt, borax and antimony are mined.

**Population.** The leading centers in Argentina are Buenos Aires, the capital; Rosario, the second city

and port; Córdoba; Avellaneda; La Plata; Santa Fé; Tucuman; Bahia Blanca, the third port; Paraná and Mendoza (*see* separate articles on these cities). The people are practically all of European birth or descent. Except in the north the Indian population has been nearly exterminated and Negroes descended from the slaves of colonial days soon disappeared. A minor fraction of the people have Indian or Negro blood in their veins. It is the racial character of the people of Argentina and Uruguay that differentiates these two countries from all others in Latin America. The population of Argentina increased very slowly until orderly government was established, then European immigration increased rapidly. In 1895 the population was nearly 4,000,000; in 1915 it had doubled; but during the World War and in years immediately following, the increase was slight. In 1930 the population was 11,192,702. The government takes active measures to induce European immigration. Among the newcomers, the Italians are the most numerous, with Spaniards ranking second. An increasing number of Germans, Poles and other non-Latin Europeans are arriving; there are few Asiatics. The half-breeds, Indian and white, known as the *gauchos*, are disappearing and now number scarcely 200,000. There are about 35,000 civilized and a few small tribes of uncivilized Indians.

**Government.** Since 1853 Argentina has been governed under a Federal system somewhat similar to that of the United States which served as a model. In Argentina, however, the local entities, called provinces, do not participate as such in the amendment of the constitution. Moreover, under the constitutional provisions which permit the Federal government to intervene in the provinces in order to insure the republican form of government, the governors of the 14 provinces have become the political agents of the president rather than independent local executives.

The constitution contains numerous guaranties of individuals and property, including freedom of worship, but the Roman Catholic Church is the established church and the President and Vice-President must belong to it. The President, whose powers are somewhat more extensive than those of the President of the United States, is chosen indirectly by an electoral college for a term of six years and is debarred from immediate reelection. He must have an income of 2,000 pesos per year and be at least 30 years of age.

The National Congress consists of the Senate and the Chamber of Deputies. The Senate is made up on the basis of equal representation of the provinces, two being chosen by the legislature of each province. The Federal district of Buenos Aires also has two senators selected by a special electoral college. The senatorial term is nine years and indefinite reelection is permitted, one-third of the Senate being renewed every three years. A property qualification is required for senators, but not for members of the lower house, who are elected by direct popular vote in the various provinces for a term of four years and may be

relected indefinitely. All laws relating to taxes and the recruiting of troops must originate in the Chamber of Deputies. The Federal courts are similar in organization and functions to those of the United States. The basis of the franchise is adult male suffrage after the age of 17 and voting is secret and compulsory.

**Education.** The people of Argentina have made remarkable progress in education and culture. The rate of illiteracy has been reduced to 40% or lower; the public schools are almost adequate for the children of school age; and there are numerous normal schools and five good universities. In literature, history, law, political science, journalism, sociology, art and music there has been great progress, although science and technology have lagged somewhat behind. In most respects Argentina deserves to rank among the progressive nations of the world.

**ARGENTINA, HISTORY OF.** There is some doubt as to whether the Plata River was discovered by Juan Díaz de Solís in 1512 or 1513. There is no doubt, however, as to the voyage there of the same explorer in 1516. After him, in 1520, Ferdinand Magellan visited the Plata and other points on the coast to the south. Lured by stories of silver, Sebastian Cabot, in 1526, sailed up the River Plata, or Solís, and founded Ft. Sancti Spiritus. In 1535 one of the best equipped expeditions ever outfitted in Spain left under Pedro de Mendoza as governor and *adelantado*. Mendoza built, in 1536, the fortified town of Santa Maria del Buen Aire, which was, however, destroyed almost immediately. Mendoza had brought with him seeds, tools and horses. In the plains or pampas the horses multiplied rapidly and were soon in common use by the aborigines. Domingo Martinez de Irala, elected governor by the colony after the departure of Mendoza, governed, except for one short interval, from 1539 to 1552. In 1542 Alvar Nuñez Cabeza de Vaca was sent to replace him. His rule proved unsatisfactory and two years later Irala sent him back to Spain in irons. Irala was noted for his "active genius and organizing spirit." In 1573, Juan de Garay founded the town of Santa Fé, and this prepared the way for Garay to found definitely the city of Buenos Aires in 1580. Other colonizing currents flowing from Peru and Chile resulted in the building of many interior towns. Some of these became the capitals of provinces and centers of culture. Cordoba had a university, 1613, and Tucuman a bishopric.

In the 17th century the colony settled down to the monotonous life imposed by the monopolistic policy of Spain and by the jealousy of the Lima merchants. In 1617 Buenos Aires was separated from Asunción and made a province or *gobierno*, and in 1622 an *Aduana Seca* (an inland customs house) was established at Cordoba. Henceforth all the trade of the province of Buenos Aires had to pass through that city on its way to Lima, and a fifty per cent. customs duty was levied on all goods. This measure enhanced the profits and volume of contraband trade,

and a short-lived *Audiencia* was set up in Buenos Aires, 1661-71, to cope with this illegal traffic.

**18th Century.** With the accession of the Bourbons in 1701 more favorable conditions began. After 1721 many measures furthered the economic development of Buenos Aires. Politically the situation was vastly improved when, in 1776, most of present-day Bolivia, Paraguay, Uruguay and Argentina was united to form the viceroyalty of La Plata, with Buenos Aires as the capital. New administrative institutions were introduced, such as the *intendencias*, 1778 and 1783, new ports of entry, the *Audiencia*, 1783, and the *Consulado*, 1794. The reasons for creating the viceroyalty were indicative of the trends in the internal and external life of the preceding fifty years of the colony. A dispute of long standing between Spain and Portugal over the boundaries between their South American colonies was only settled in 1777. The extent of the territory of the viceroyalty of Peru was too great for efficient control. The English and Portuguese were threatening to occupy the region of Patagonia and the French had already in 1764 occupied the Falkland Islands. Not least among the considerations of Charles III of Spain was his desire to stave off a revolution in his dominions such as was taking place in North America.

The period of the viceroyalty was one of rapid progress. Its prosperity attracted the attention of the British, who towards the end of the viceregal period in Buenos Aires were at war with Napoleon and with Spain, his ally. In 1806 an English expedition captured the city of Buenos Aires. The viceroy who fled before the British was declared deposed by a *cabildo abierto*, an open town meeting, in Buenos Aires. The inhabitants of the city chose Santiago de Liniers, later to become viceroy, as their leader in a popular movement to oust the British. The latter lost no time in spreading liberal ideas among the inhabitants. The invaders, however, were soon expelled, and a second attempt at invasion in 1807 failed. These victories of the citizens of Buenos Aires gave them a marked degree of self-confidence.

**Revolution.** Events in Spain during 1807-10 precipitated a crisis in the viceroyalty of La Plata. A *junta* in Buenos Aires deposed the viceroy and assumed control on May 25, 1810, and from this date to 1816 was the period of the war for independence. Paraguay, Uruguay and Bolivia broke away from Spain and Buenos Aires, and many of the provinces in the present-day territory of Argentina, jealous of Buenos Aires' ascendancy, sought freedom from the great influence of the capital city. JOSÉ DE SAN MARTÍN was the hero of the war, not only in Argentina but in Chile and Peru.

The years from 1816 to 1829 were chaotic. The problem of governmental organization proved to be a most difficult one. Monarchists, federalists and centralists all worked to impose their own political ideals. The inhabitants of Buenos Aires sought to retain and increase their leadership, while the provinces were equally determined that the capital city



should not overshadow them politically or economically. Civil wars, revolts, and the rule of *caudillos* were frequent phenomena up to 1853.

In 1816 a congress at Tucumán declared formal independence from Spain. Juan Martín Pueyrredón was made supreme director and a centralizing constitution was drawn up, but was not acceptable to the provinces. War against Buenos Aires in 1820 resulted in a victory of the provincial federalists and from that time to 1826 there was no national government. In 1824 a constituent assembly met in Buenos Aires and in 1826 another constitution similar to that of 1816 was framed, only to be rejected like the first. In 1825 war with Brazil over the possession of Uruguay had broken out and in 1826 Bernardino Rivadavia was elected President of the "United Provinces of the Río de la Plata." He resigned the next year. Peace with Brazil in 1828 gave Uruguay its independence. Buenos Aires became autonomous again and a revolution in 1829 gave Juan Manuel de Rosas an opportunity to assume a commanding position in the affairs of the Argentine provinces.

Rosas, ostensibly a federalist, was elected by the legislature governor of Buenos Aires in 1829, and again in 1835 when he demanded dictatorial powers, to be ratified by a plebiscite. Until 1852 he governed Buenos Aires, controlled the foreign affairs of the Argentine confederation and interfered in the internal affairs of many provinces. Engaged in war with France and England, he successfully defended the independence of the country. In 1851, however, Uruguay, Brazil and the provinces of Corrientes and Entre Ríos joined in an alliance under the leadership of Gen. Justo José de Urquiza, governor of Entre Ríos, against Rosas. The latter was defeated in 1852 and a new era began in Argentina.

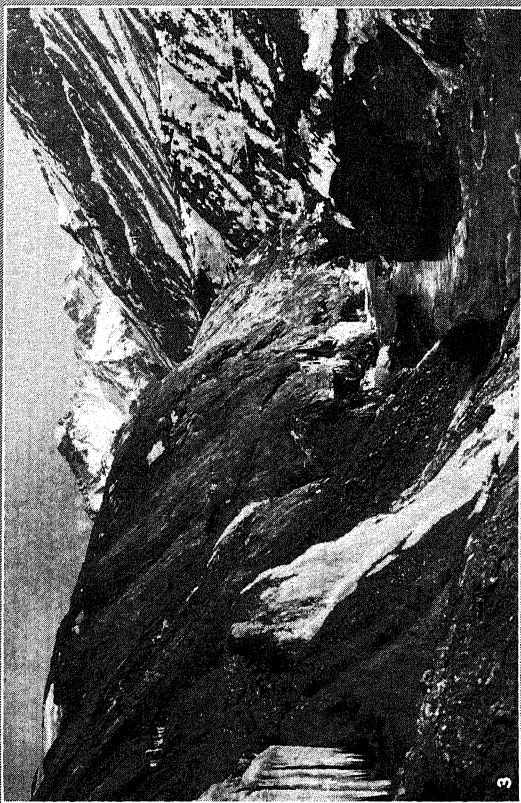
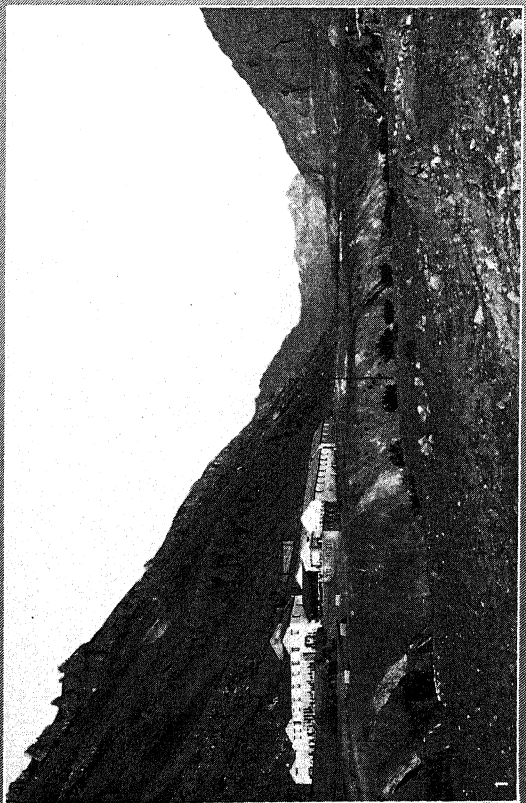
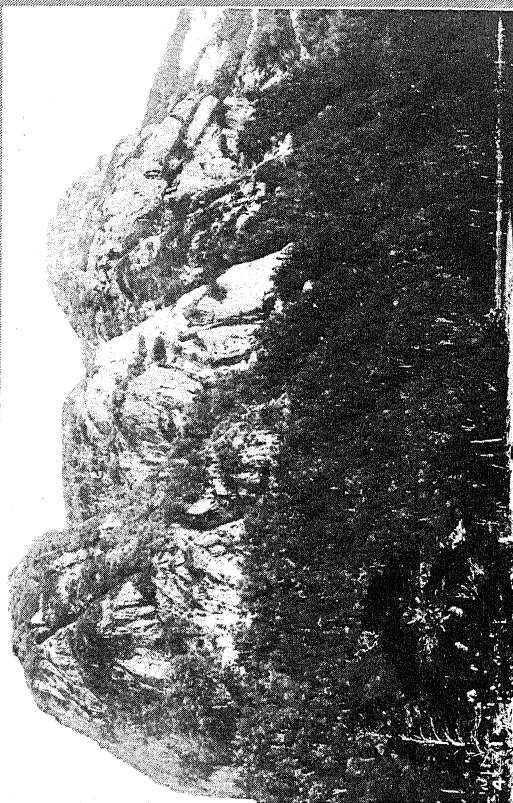
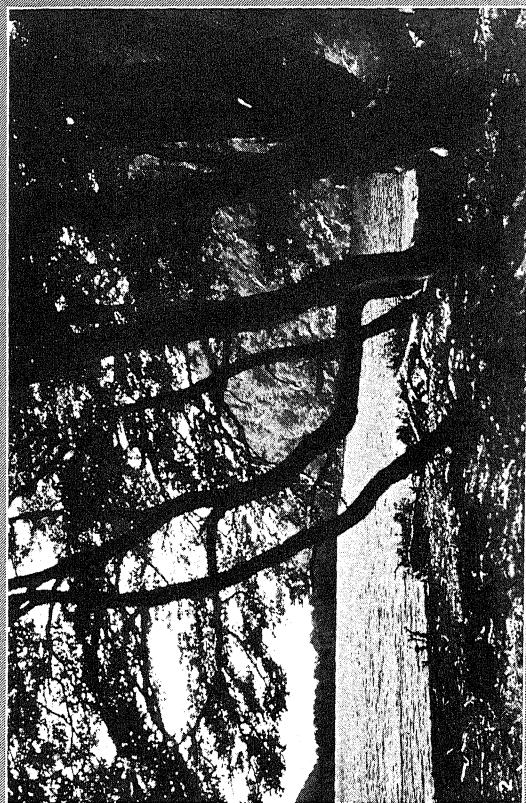
Urquiza called a constituent congress which met in Santa Fé in 1852. There Juan Bautista Alberdi powerfully influenced the writing of the constitution, which was similar in many respects to the Constitution of the United States. This, with some amendments, is the constitution which still obtains in the Argentine to-day. Urquiza was elected President and established the capital of the republic in Paraná in the province of Entre Ríos, allowing the province of Buenos Aires to remain apart. Now that the form of government had been settled there remained only the problem of the capital. In 1856 Rosario was chosen as the chief port, and preferential tariffs on European imports alarmed and aggrieved the inhabitants of Buenos Aires. They took retaliatory measures and in 1859 war broke out, with a victory of the federalists over Buenos Aires. After Buenos Aires entered the confederation, however, the province revolted again under the leadership of Gen. Bartolomé Mitre, and overthrew the national administration. Mitre secured his election as constitutional president in 1862 and established his capital in Buenos Aires. But the question of the capital was only definitely settled in 1880 after a bloody struggle when Buenos

Aires was federalized and the capital of the province of Buenos Aires transferred to La Plata.

**Unification and Progress.** With the accession of Mitre began a series of administrations distinguished by the services of eminent statesmen and scholars. National unification, immigration, education, the development of industries, and the greater exploitation of natural resources were the problems to which the various governments devoted themselves, generally with success. Argentina now occupies a dominating position in the wheat and meat markets of the world. Only two revolutions of account and one foreign war have disturbed its peace. With tranquillity and the solution of the problems that had racked the nation from 1810-62, Argentina is forging to a position of leadership among the nations of the Hispanic-American world.

Mitre gave attention to postal and telegraphic communications, to railroads and to the prosecution of the Paraguayan War, 1865-70. A commercial code was drawn up in 1862. In 1868 Mitre was followed by Domingo Faustino Sarmiento, the "schoolmaster president," 1868-74. He governed along lines similar to those of his predecessor, but with special emphasis on the development of the educational system of the nation. From 1874 to 1880 Nicolás Avellaneda was president. Exports increased, European immigration was actively fostered, and a land law was passed to facilitate the buying of government land. Large landed estates increased as a result of this law which had no provisions to forestall such an issue, and the development of a landed aristocracy was fostered. In 1880 Buenos Aires was made the federal capital and Julio Roca, who had won renown in a war against the Indians in Patagonia, became president. At the end of his term he favored the candidacy of his brother-in-law, Miguel Juárez Celman. Celman's presidency was marked by graft and corruption and the Union Cívica, a radical party, was formed to oppose the conservative party in power. The Union Cívica in 1890 fomented a revolution which led to the resignation of Celman. In the next year payments on the foreign debt were suspended and bankruptcy was imminent. Luis Sáenz Peña, a compromise candidate, was elected in 1892, but resigned in 1895 because of opposition to his methods. The continued growth of industry and agriculture eased the economic situation and assisted in the material recovery of the country. Due chiefly to the initiative of President Roque Sáenz Peña, a secret compulsory voting law was passed in 1912, and in 1916 Hipólito Yrigoyen, a radical, was elected president. He kept Argentina out of the World War and developed a nationalistic program which included some beneficial laws for the laboring classes. Marcelo T. Alvear, president from 1922-28, was able to obtain passage of a workmen's pension act before a deadlock in congress made further legislation difficult if not impossible. In 1928 Yrigoyen was elected for the second time; but his unconstitutional measures, and the increasing paralysis of government in the face of a

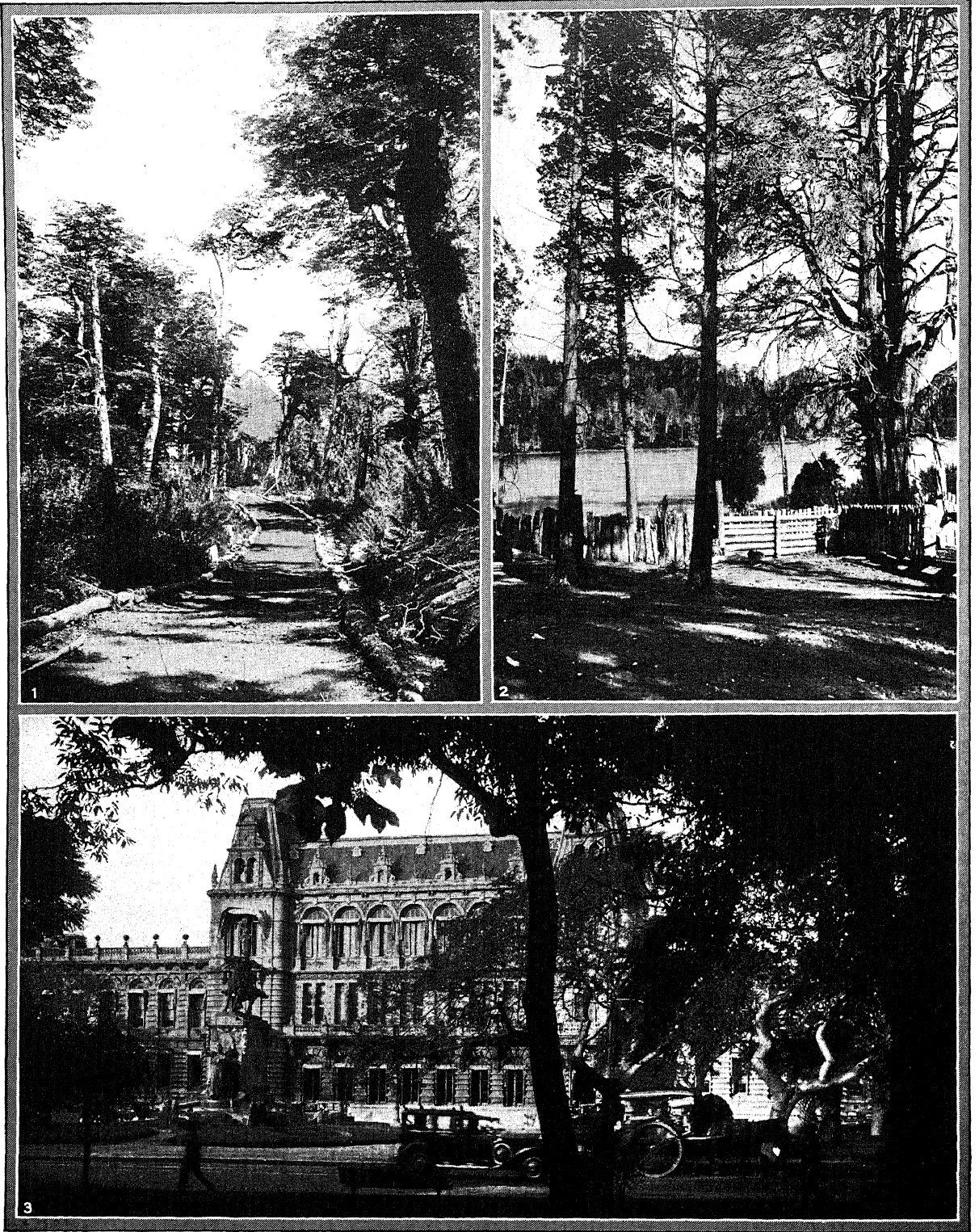
# ARGENTINA



## SCENES IN THE ANDES AND THE BLACK RIVER TERRITORY, ARGENTINA

1. Hotel Inca Point, in the Andes.
2. Dora Lagoon on the Black River.
3. The Horcones River in the Andes.
4. The Three Brothers Rock in the Black River territory.

## ARGENTINA



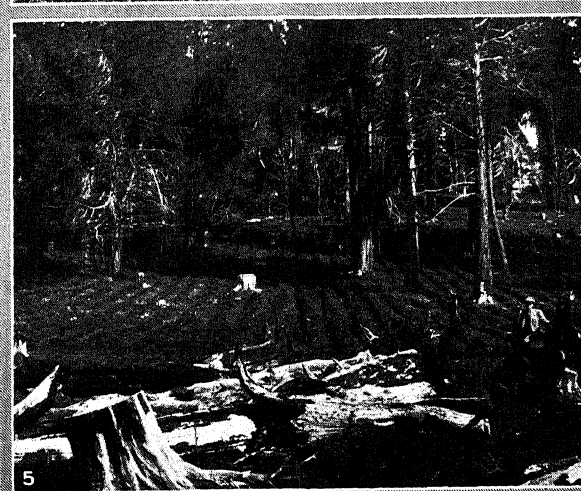
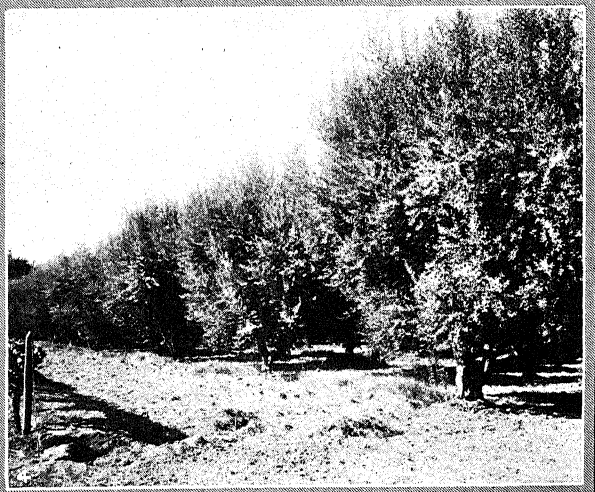
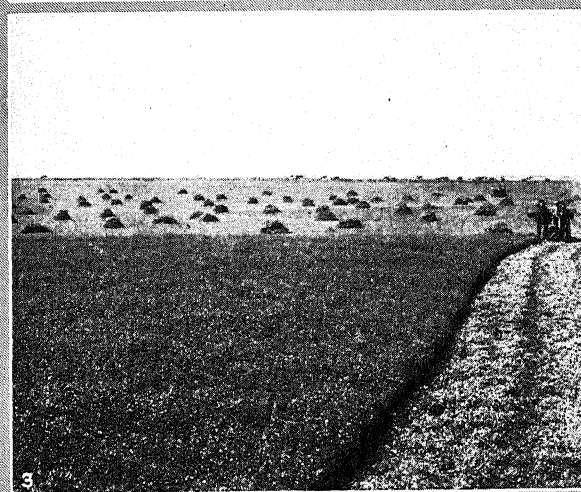
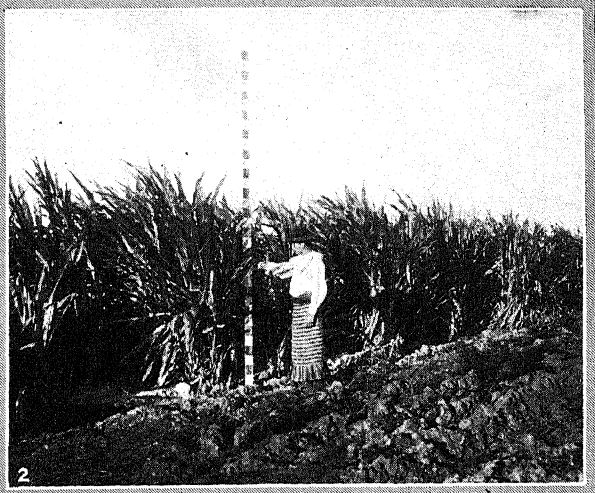
COURTESY MINISTER OF AGRICULTURE, ARGENTINE REPUBLIC

### CITY AND COUNTRY SCENES IN ARGENTINA

1. Road to the summit of Bariloche, Black River district.
2. View of Gutierrez Lake, in the neighborhood of Lake Nahuel Huapí in the Black River district.
3. Headquarters of the National Council of Education, Buenos Aires.



# ARGENTINA



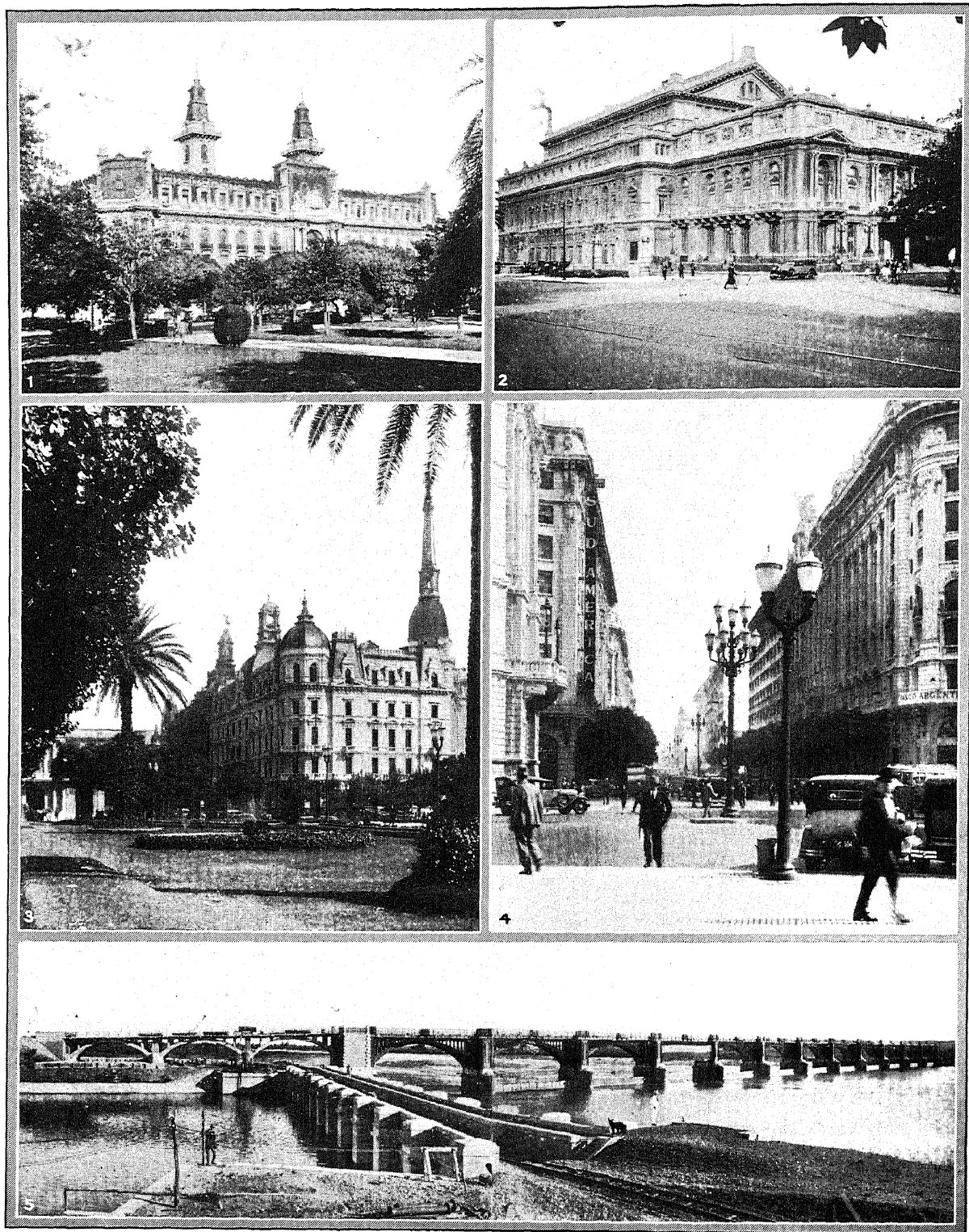
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## MODERN AGRICULTURE IN ARGENTINA

1. Students of the Casilda School of Agriculture cutting wheat. 2. Argentine sugar cane. 3. Harvesting alfalfa on broad plains of Argentina. 4. Pineapple trees at Vitivincola

School, Mendoza. 5. Planted clearing in the virgin forest of Victoria Island. 6. Growing yerba maté at Loreto Experiment Station (Misiones).

# ARGENTINA



COURTESY MINISTER OF AGRICULTURE, ARGENTINE REPUBLIC

## BUENOS AIRES AND THE BLACK RIVER DAM

1. Customs Building in the Argentine capital. 2. Columbus Theater. 3. Municipal Administrative Building.
4. Roque Sáenz Peña Avenue. 5. An irrigation dam at the mouth of the Black River in Contralmirante Cordero.





ARGENTINA

Ar. 1,153,119 sq.m.  
Pop. .... 11,644,000

PRINCIPAL CITIES

(Including Figures from Latest Population Estimates)

Pop.—Thousands  
210 Avellaneda

59 Azul..... J 17  
100 Bahia Blanca

42 Balcarce..... C 15  
30 Baradero..... M 13

50 Bolivar..... O 16  
2031 Buenos Aires

28 Campana..... N 18  
30 Carlos Casares

57 Chacabuco..... N 17  
29 Chascomus..... Q 20

68 Chivilcoy..... N 17  
23 Concepcion del Uruguay

78 Junin..... M 19  
180 La Plata..... N 20

13 La Rioja..... J 9  
33 Las Flores..... O 13

46 Lincoln..... L 15  
31 Lobos..... L 18

33 Luján..... L 18  
62 Mar del Plata

70 Mendoza..... C 20  
45 Mercedes..... M 17

41 Necochea..... O 18  
57 Nuevo de Julio

49 Olavarría..... P 17  
65 Paraná..... L 17

98 Pergamín..... N 17  
26 Pringles..... C 16

30 Resistencia..... L 13  
456 Rosario..... M 16

36 Saladillo..... O 18  
34 Salta..... C 10

49 San Fernando..... N 18  
30 San Francisco

39 San Isidro..... N 19  
50 San Juan..... L 7

25 San Luis..... M 10  
50 San Nicolas

40 San Pedro..... M 18  
121 Santa Fe..... L 16

41 Santiago..... J 12  
61 Tandil..... P 18

66 Tres Arroyos..... C 17  
133 Tucumán..... H 10

43 Zarate..... N 18

CHILE

Area 290,195 sq.m.  
Pop. .... 4,287,445

PRINCIPAL CITIES

(Including Figures from Latest Population Estimates)

Pop.—Thousands  
14 Antofagasta..... F 3

52 Cauquenes..... O 3  
40 Chillan..... P 3

73 Concepcion..... P 2  
11 Copiapo..... L 4

17 Coquimbo..... K 3  
19 Curico..... N 3

15 Iquique..... O 4  
13 Los Andes..... M 4

35 Lota..... P 2  
34 Magallanes..... E 2

16 Osorno..... A 19  
16 Puerto Montt..... B 19

Punta Arenas, see Magallanes

15 Quillota..... M 3  
13 Rancagua..... N 5

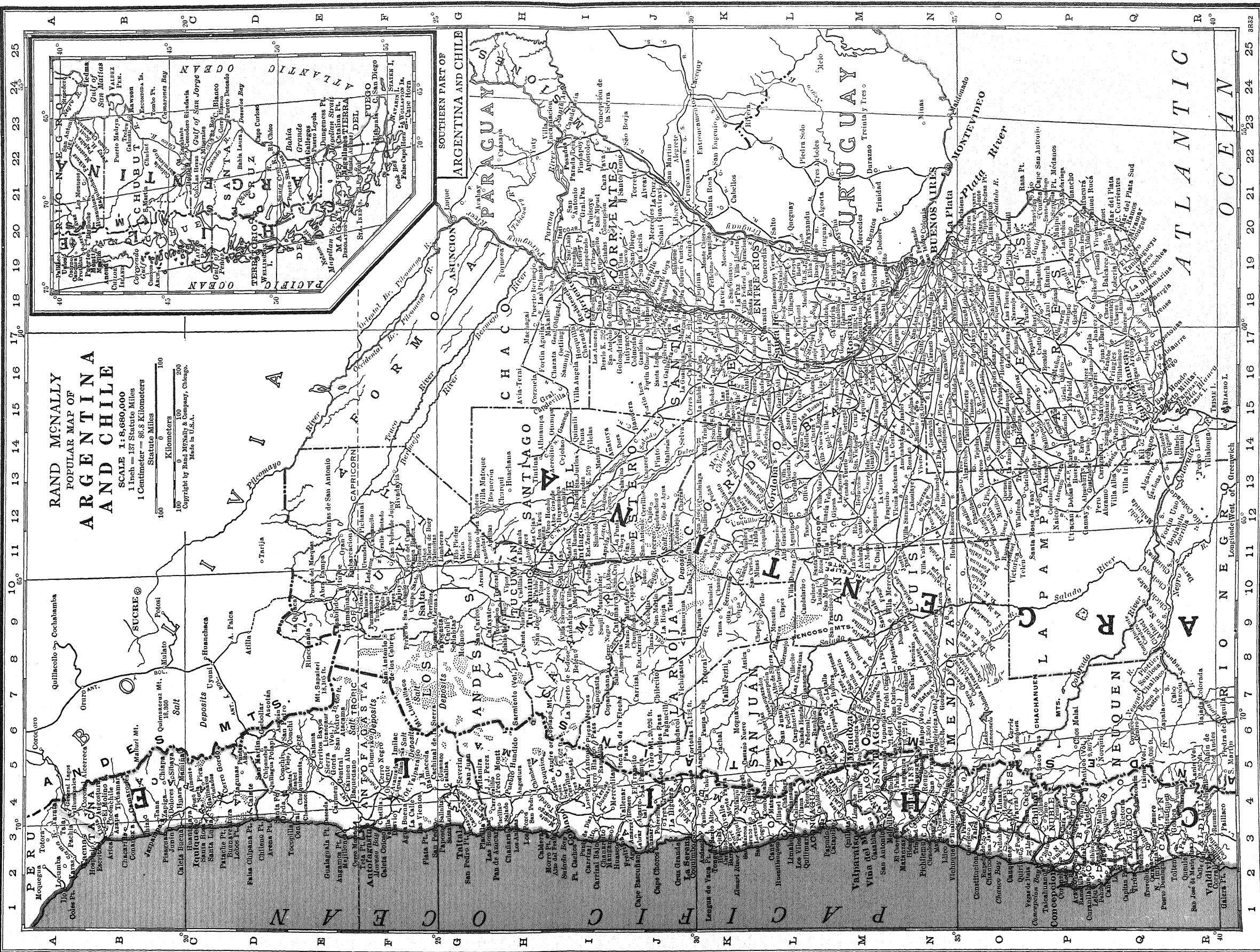
13 San Fernando..... N 4  
696 Santiago..... M 4

21 Serena, La..... J 3  
45 Talca..... O 3

28 Talcahuano..... P 2  
36 Temuco..... C 3

34 Valdivia..... R 2  
193 Valparaiso..... M 3

49 Vina del Mar..... M 3





serious economic crisis, led to a revolt in 1930. Its leader was Gen. José Evaristo Uriburu who became the provisional President of the country. P. V. S.

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**ARGENTINE ANT** (*Iridomyrmex humilis*), a native ant of Brazil and Argentina, probably brought to the United States either in cargoes or on the bottoms of ships from South America. It now infests the southern parts of Louisiana, Mississippi, California and Texas, where it is a great household and horticultural pest. This ant destroys entire fruit crops by eating the buds and blossoms. It also protects the aphid which is so injurious to sugar cane and other plants. When the Argentine ant enters a dwelling, it penetrates to every corner. The only remedy is to exterminate the whole nest, for which carbon bisulphide or arsenic have been found effective. See ANT; APHID.

**ARGENTINIAN LITERATURE**, the literature of the Argentine Republic, South America, which is treated under the heading, LATIN-AMERICAN LITERATURE.

**ARGENTITE**, a sulphide of silver and valuable ORE of that metal, about as heavy and as soft as lead and resembling it somewhat in appearance. It is called also silver glance. Argentite occurs as a primary mineral in gold-silver veins, as at Tonopah, and the Comstock Lode in Nevada, and in the rich veins of Mexico. Alteration of argentite by the oxidation of WEATHERING agents produces native silver, usually in wire form, as at Kongsberg in southern Norway. Secondary argentite is also found, resulting from the weathering of preexisting silver compounds. Argentite is usually deposited at comparatively shallow depths beneath the surface, in company with other silver minerals, as pyrargyrite, proustite, TETRAHEDRITE, native silver, and with native GOLD, QUARTZ and CALCITE. See also ORE DEPOSITS; VEIN.

**ARGENTUM**, Latin name for the element silver (symbol, Ag). For various preparations with the prefix *argent*, see under SILVER.

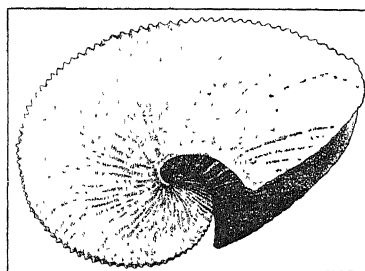
**ARGILLACEOUS**, a term applied to loose sediments or compacted rocks containing much clayey matter, or derived principally from CLAY. An argillaceous sandstone is one containing some clay. See also ARENACEOUS.

**ARGO**, the mythological ship which carried the ARGONAUTS to Colchis in quest of the Golden Fleece.

**ARGON**, a chemical element (symbol, A; at. wt. 39.94) belonging to the group of rare gases, discovered

by Rayleigh and Ramsay in 1894. It is a colorless, odorless gas, comprising about 0.93% of the atmosphere; is slightly soluble in water and liquefies at  $-187^{\circ}$  C. Because of its inertness, argon is used in incandescent lamps.

**ARGONAUT**, a common name for a species (*Argonauta argo*) of cephalopod mollusk which belongs to the same order (*Octopoda*) as the octopus. It is also called the paper nautilus, but it is only



COURTESY AMER. MUS. OF NATL. HISTORY

ARGONAUT OR PAPER NAUTILUS

*Argonauta argo*

very distantly related to the true nautilus. The argonaut lives in all tropical and subtropical seas, where it spends most of its time at the surface, submerging like a submarine when disturbed. However, it has been taken from depths of over 3,000 ft.

The argonaut shell is unique. It is borne only by the female, and is secreted by two of her eight arms, and not by the mantle as in all other mollusks. It is a really a brood pouch, within it the eggs are hatched, and there the young remain until they can fend for themselves. This shell, sometimes 6 in. long, is coiled in one plane like that of the true nautilus, but it is semi-transparent, sculptured with transverse ribs, and is not chambered. When wet it is pliable. The arms, which make the shell and are also used to hold it in place, are webbed.

The argonaut can leave her shell for a few minutes, but usually she may be found apparently sitting in it, with only her head and tentacles showing. The name is due to the ancient fable that she makes voyages on the surface, using her shell for a boat and her webbed arms for sails. Actually she swims backward by forcing water through her funnel, like other cephalopods. The shell-less male may be only 1/15 as large as the female. One of his arms is specialized into a sexual organ (*hectocotyle*) which separates from his body and moves by itself to the female.

A. I. W.

**ARGONAUTS**, legendary Greek heroes numbering about 50, who sailed on the ship *Argo* to seek the Golden Fleece in Colchis. The voyage was instigated by PELIAS, who had usurped the throne of Iolcus in Thessaly, in order to rid himself of his nephew Jason, whose father, Aeson, was the rightful king. Jason, accepting the task, invited the bravest men in Greece to accompany him in his quest for the Fleece, which was that of a sacred ram. This jealously guarded prize was hanging on a tree in an

oak grove at Ares in Colchis. The band of heroes, which included HERCULES, THESEUS, CASTOR AND POLLUX, sailed from Iolcus, crossed the Aegean Sea, arrived at Lemnos and proceeded up the Hellespont, entered the Black Sea and finally, after innumerable adventures, arrived in Colchis. Here, after further breathless escapes, Jason obtained the Fleece, aided in the undertaking by King Aetes's daughter, MEDEA, with whom he had fallen in love. Accompanied by Medea and pursued by Aetes, he sailed from Colchis and in due time arrived safely at Iolcus. The adventures of the Argonauts are frequently described by the old Greek poets, but with wide variations of incident.

**ARGO-NAVIS** (gen. *Argus*), the ship Argo, the largest constellation in the sky containing numerous bright stars. It was placed in the heavens in honor of the voyage of the Argonauts, about 1300 B.C., but owing to its tremendous size it has been subdivided into four, viz., CARINA, the keel, PUPPIS, the poop or stern, VELA, the sails and Malus, the mast. The last mentioned has been abandoned and replaced by PYXIS, the compass. See STAR: map.

**ARGONNE**, a rocky, heavily timbered plateau in Lorraine, northeastern France. It is 44 mi. long, and about 10 mi. wide. The Argonne, stretching in a southeast to northwest direction, is traversed lengthwise by the Aire River and smaller streams. The western slope of the plateau is bounded by the Aisne, while the east side is determined by cliffs. The woods of the Argonne are about 25 mi. long. The military value of the area has been increased in recent years by the construction of the elaborate fortifications of Verdun, a few miles southeast. The Argonne figured in history during the campaign of Dumouriez in 1792, in the Franco-Prussian War of 1870-71, and in the World War, during which it was the scene of the fiercest battle waged by American troops. In Sept. 1918, American and French divisions were concentrated in front of the Argonne woods, which had been a quiet sector. The Germans held the woods, and had three lines of defense in support. On the 26th, the French Fourth Army launched an attack on the west side of the woods, while the First American Army advanced several miles on the east side. By Oct. 10 the German positions were outflanked. The Argonne-Meuse operation, which showed the Allies the calibre of the American Expeditionary Force, resulted in the capture of 847 cannons, 3,000 machine guns and 26,000 prisoners. The American losses were 117,000 killed and wounded. The winning of the Argonne cut off the German main line of communication, and opened the way to the Allied campaigns which soon ended hostilities.

**ARGUS**, in Greek mythology a hero supposed to have 100 eyes, only two of which slept at a time. He was called *Panoptes*, all-seeing. Hera put his eyes into the tail of the peacock. He was thought to represent the starry heavens, and was the mythological founder of Argos.

**ARGYROKASTRO**, a town in the south of ALBANIA situated amid treeless hills about 20 mi. from

the Adriatic Sea. It is built about the ruins of a fort, from which it derives its name, and which fell in the hands of the Turks in 1420. In 1913 the town became part of the newly created Albanian state, though the Greeks presented strong claims for it. About three-fourths of the inhabitants are Albanian Moslems and one-fourth are Christians. Argyrokastro is a trading point for woolens, cheese, carpets and tobacco products. Pop. 1930, 10,836.

**ARIA**, the Italian name for air or melody, is a vocal solo with instrumental accompaniment, usually of considerable length and pretension, such as may be found in the opera and oratorio. In many cases it is introduced by a recitative or declamatory set of phrases. It is distinguished from the song in not being an independent composition and, at least in opera, in submitting to more ornate construction and delivery. The *aria da capo* generally has a short instrumental prelude and is divided into two contrasting sections, after which the first section is repeated. *He was despised* in Handel's *Messiah* is an *aria da capo*.

**ARIADNE**, in Greek mythology, the daughter of MINOS, King of Crete. She aided THESEUS to slay the Minotaur, giving him a thread by which he found his way out of the labyrinth, and he married her. On their way to Attica they stopped at the island of Naxos, where Theseus deserted her as she slept.



COURTESY M. OF FINE ARTS, BOSTON

THESEUS ABANDONING ARIADNE  
From a red-figured vase painting. Late 5th  
century B.C.

DIONYSUS found her and married her. His bridal gift was a crown and this after her death was placed among the stars.

**ARIANISM**, a widespread heresy which disturbed the Christian Church in the 4th century. (See GNOSTICISM). The Godhead was defined as a TRINITY, namely three persons in one. In the Greek mind, accustomed to the language of Plato and Aristotle, there arose a desire to examine the precise relation between the Father and the Son. (See MONOPHYTES.) On the one hand, the Sabellians sought to simplify the speculation by declaring that the Three Persons in the one God are, in effect, indistinguishable, which led them to the startling conclusion that God the Father had been born of a Virgin and suffered on the Cross, whence the term Patripassians applied to these heretics. On the other hand, the Arians declared that there must be a definite distinction drawn between the Father and the Son. The orthodox party

in the Church insisted on *homoousia*, or sameness of essence, between the Persons of the Godhead. But the Arians preferred *homoiousia*, or similarity of essence, which distinction expressed in the single letter "i" rent Christendom asunder, as was caustically said by Gibbon, "over a diphthong." According to orthodoxy, the Father and the Son have always been coexistent, but the Arians held that there was a period when the Father existed without the Son, and this belief was held to be a denial of the full deity of Christ, who was thus reduced in effect to what Paganism recognizes as the status of a demigod. The controversy between the parties in the Church was incredibly bitter and bewilderingly complicated. It is most conveniently narrated under **ARIUS** and his great opponent, **ATHANASIUS**. The final outcome has been the **NICENE CREED**, which declares the triumph of the orthodox party by declaring belief "in one Lord Jesus Christ, the only begotten Son of God, Begotten of his Father before all worlds, God of God, Light of Light, Very God of very God, Begotten, not made, Being of one substance with the Father by whom all things were made." It will be seen that these phrases have to be read in the light of the tremendous controversies out of which they emerged.

**ARICA**, a port of Chile situated in the province of Tarapacá, the first Chilean port coming from the north. By a treaty signed in 1929 by Chile and Peru as a termination to the long-standing Tacna-Arica question, the town of Arica was definitely assigned to Chile under certain conditions mutually agreed upon. The climate of Arica is excellent, perhaps the best in this region, and the harbor is ample and is well-sheltered on the southwest by Alacran Island. There are two railroads, one connecting Arica with Tacna, an inland town, and one connecting to La Paz, Bolivia. The "Morro de Arica," a rock rising 152 meters from the southern side of the harbor, is a historical landmark of the war against Peru and Bolivia in 1880. Pop. 1930, 13,140.

**ARIDITY**, or dryness, the opposite of **HUMIDITY** or moistness, a condition of the atmosphere characterizing desert regions where the rainfall is very low, or high mountain plateaux and arctic regions where, although owing to the low temperature there is nearly always snow present, the humidity of the atmosphere is low. Rainfall, however, is not the sole determining factor as may be seen in some regions of South Africa, for example, where the average rainfall is higher than in moist climates such as London or San Francisco, but where the rainfall is sudden and intense, the water being carried off by rivers almost in its entirety and not sinking into the ground from which it could later evaporate into the atmosphere.

Agriculture becomes very difficult in climates where the rainfall or the humidity are low as is evident from the very peculiar form of vegetable life existing in arid districts. Cactus and agave form the typical plants of such regions, these having thick stems and leaves with a hard, leathery skin which prevents un-

due evaporation of moisture. The internal parts of these plants, however, are often very juicy. Animal life in dry climates, too, generally adapts itself to the peculiar conditions and beasts usually keep out of sight during the middle of the day.

The Sahara and the extensive belt of dry regions in Asia, such as the Arabian, Persian and Gobi deserts, are the best known examples of arid climates. In America the desert between the Rocky Mountains and the Sierras as well as the Atacama desert in Chile may be mentioned. It should be added, however, that the artificially heated offices and homes in our cities often contain air inside of even greater aridity than that of the Sahara.

**ARIEL**, a spirit occupying varying rôles. In the *Cabala* he is a water spirit, in medieval literature often a guardian angel of innocents. In Shakespeare's *Tempest* he is a cheerful spirit whom Prospero finds imprisoned in a tree and releases to serve his own beneficent purposes. In *Paradise Lost* Milton makes him a rebel angel.

**ARIES** (gen. *Arietis*), the ram, the first constellation of the Zodiac composed chiefly of three stars of the second, third and fourth magnitude respectively. At the time when the **ZODIAC** was first conceived of, the sun, in its annual course around the heavens entered within the limits of the constellation Aries on the first day of spring, at the vernal equinox, for which reason the vernal equinox, that imaginary point upon the celestial sphere, is also called First Point of Aries. Owing to the precession of the equinoxes the first point of Aries has now moved out of the constellation Aries and almost through that of Pisces even. See **STAR: map**.

**ARIKARA**, a Plains Indian tribe speaking a language of the Caddoan stock. Unlike the most typical Plains tribes they were semi-sedentary, cultivated maize and hunted the buffalo and during the 19th century, lived in earth-lodge villages on the Missouri River, in close association with the **MANDAN** and **HIDATSA**. Earlier in their history they were federated with the Pawnee. Culturally they have many traits which are more closely affiliated with those of the southern Plains tribes as, for example, the great stress on ceremonies connected with maize, their village organization and burial in mounds. Only a few hundred individuals now survive, living on the Fort Berthold Reservation in North Dakota.

**ARIMINUM**. See **RIMINI**.

**ARION** (c. 625 B.C.), Greek poet and musician, was born at Lesbos. He is credited with having invented the dithyramb, but none of his writings are extant. There is a myth that while he was sailing from Tarentum to Corinth with vast treasure, the sailors schemed to kill him for his wealth. As a last favor he begged that he might sing a song accompanied by his lyre. This was granted. As he finished he threw himself into the sea and was borne up on the back of a dolphin that had been attracted to the ship by the music. The dolphin carried him safely to land before the arrival of the ship.



**ARIOSTO, LODOVICO** (1474-1533), Italian epic poet, was born at Reggio, Lombardy, Sept. 8, 1474, of a noble family. He studied law for a number of years, but turned with greater devotion to the classics. Forced after his father's death to support a large family, the poet entered the service of Cardinal Ippolito d'Este in 1503 and undertook to complete and perfect Boiardo's *Orlando Innamorato*. Under the cardinal's patronage he wrote the famous epic poem, *ORLANDO FURIOSO*, glorifying in a double sense the House of Este and its mythical founder. Its 46 cantos of polished imagination and romance have been the delight of readers and the despair of poets ever since. From his patron's brother, the Duke of Ferrara, Ariosto received in 1518 a post as governor of an obscure and bandit-infested province in the Apennines. He held this post for several years, but about 1521 turned to Ferrara. His fame as a poet spread in his latter years. Dukes and princes, as well as cardinals, popes and men of letters delighted to honor him. He busied himself in repolishing his great work and in composing four comedies in imitation of Plautus and Terence. He also wrote satires on the style of Horace and some sonnets of mixed worth. Ariosto died of consumption in Ferrara, in comparative poverty, June 6, 1533. See also ITALIAN LITERATURE.

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**ARISTARCHUS OF SAMOTHRACE** (c. 220-c. 144 B.C.), Greek scholar and critic of the Alexandrian School, was born about 220 B.C. at Samothrace. He became the librarian of the noted Alexandrian Library, succeeding his teacher, Aristophanes of Byzantium. He was engaged as tutor to the children of the ruling Ptolemy. Aristarchus founded a school of philosophers, the Aristarcheans. He did valuable work in purifying the text of Homer, and edited many Greek poems. His commentaries number over 800. Aristarchus spent the latter part of his life in Cyprus and died there about 144 B.C.

**ARISTIDES** (c. 530-468 B.C.), Athenian statesman, general and admiral at the time of the Persian invasions of Greece. Commander of part of the Athenian army at the BATTLE OF MARATHON in 490 B.C., he was elected chief magistrate or *archon* of Athens in the following year in recognition of his services. He opposed the naval policy of THEMISTOCLES, preferring to develop the power of Athens on land. This conflict resulted in his ostracism, but recalled by virtue of a general amnesty extended to exiled Athenians in 480 B.C., he cooperated loyally with Themistocles in the campaign of Salamis. (See SALAMIS, BATTLE OF.) Commander of an Athenian naval squadron operating near the Hellespont, 477 B.C., he regained the support of Greek cities in Ionia, which had revolted from the Spartan admiral Pausanias. Aristides took a prominent part in organizing the DELIAN LEAGUE formed by Athens as a safe-

guard against Persia. For his fairness in assessing the contributions of the members of this confederacy to the common treasury he is said to have been called Aristides the Just.

**ARISTIDES, APOLOGY OF**, was written by a Christian of this name, who lived in Athens in the 2nd century. The Apology, a defense of Christian doctrine and practice, was presented to the Emperor Hadrian, or as some say, to Antoninus Pius. It was referred to by the bishop of Vienne in the 9th century, but was lost until 1878, when a fragment was found. A Syriac version, discovered in the convent of St. Catherine, Mount Sinai, in 1889, has been translated into English.

**ARISTIPPUS** (c. 425-c. 366 B.C.), Greek Philosopher of Cyrene, was born around 425 B.C. He spent some time at the court of DIONYSIUS, was a pupil of SOCRATES, and became the leader of the Cyrenaic School (see CYRENAICS). Ethically he was a Hedonist (see HEDONISTS) and epistemologically a sensationalist and sophist (see SOPHISTS). He died around 366 B.C.

**ARISTOCRACY**, a word meaning the rule of the best. Theoretically it is to be distinguished from oligarchy, the rule of the few, or plutocracy, the rule of the rich, in that the aristocracy, being made up of those who are mentally and morally superior will govern in the interests of the governed rather than in their own selfish interests. Actually no satisfactory test of these superior qualities has ever been devised and the term aristocracy has been applied to the governing classes of all nations where such classes exist, whether that claim be based on blood, landed estates or wealth.

**ARISTOLOCHIA**, a large genus of plants of the birthwort family, comprising about 250 species, chiefly woody climbers, widely distributed in warm regions. The curiously shaped flowers, which vary greatly in size and color, are constructed so as to imprison insects that aid in pollination. Because of their hardiness and handsome foliage, various species, as the Dutchman's pipe (*A. macrophylla*) and the pelican-flower (*A. Gigas*), are much grown for shading porches and covering walks.

**ARISTOPHANES** (c. 450-c. 375 B.C.), the greatest writer of comedies in the great age of Greek drama. His father was a landowner in the island of Aegina, 10 miles off the coast of Attica, and Plato says that Aristophanes was a man of aristocratic breeding, who lived in the best society of Athens. His plays, made possible by a great democratic audience of alert Athenian citizens, were immensely powerful political appeals to that audience. They formed a part of the yearly festivals of Dionysus, god of the vine, and were presented in public competitions, as the great tragedies of Aeschylus, Sophocles and Euripides had been. Aristophanes was an extreme conservative, a pacifist, a sharp critic of democracy in government and of modernism in religion. He used his tremendous poetical power to construct plays which advanced his views. Of more than 40 plays, 11 are extant. Generally they take their names from the symbolic chorus.



The *Acharnians*, 425 B.C., written to enforce aristocratic and pacifist views, exhibits an honest Athenian farmer defending the cause of peace against a militaristic chorus of Acharnians, whose lands have been laid waste in war. The *Knights*, 424 B.C., holds up to ridicule Cleon, the tyrannical demagogue, as a dishonest slave bullying a dull old man who represents the Athenian democracy. The *Clouds*, 423 B.C., opens with an old man bewailing his luxurious wife and spendthrift son, whom the father sends to Socrates to learn wisdom. The play is an attack, through Socrates, at the scientific relationalism which the poet hated. The *Wasps*, 422 B.C., ridicules the professional jurymen of Athens, an outcome of her democratic system. The *Peace*, 422 B.C., is a political sermon seeking to bring about peace between Athens and her rival, Sparta. The *Birds*, 414 B.C., ridicules the Athenian dream of an empire in the western Mediterranean. *Lysistrata*, 411 B.C., shows the women of Athens revolting in favor of peace. Two other plays are mainly concerned with women. The *Frogs*, 405 B.C., is a bitter attack on the tragic poet, Euripides. C. J.

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**ARISTOPHANES OF BYZANTIUM** (c. 260-c. 185 B.C.), Greek grammarian, was born about 260 B.C. A pupil of Zenodotus, he was a lexicographer of importance and edited the works of many Greek poets, among them Homer and Hesiod. He was keeper of the library at Alexandria. Aristophanes died about 185 B.C.

**ARISTOTLE** (384-322 B.C.), Greek philosopher, was born at Stagira, Macedonia, 384 B.C. He came from a family of physicians, his father being court physician to King Amyntas. At the age of 17 he went to Athens and there studied at the Academy under PLATO. His unusual talents were soon recognized, and it was not long before he became a rival of his master. For 20 years he remained at the Academy, but after Plato's death, 347 B.C., he left Athens and spent several years in travel. Invited by Philip of Macedon to become tutor to his young son Alexander, Aristotle functioned in this capacity from 343 to 340 B.C. In 334 he again went to Athens, this time to found his own school known as the Lyceum. After Alexander's death Aristotle was suspected of having Macedonian sympathies because of his friendship with the Conqueror, and fled to Chalcis in 323. Here he died the following year.

The two main influences brought to bear upon Aristotle were his father's profession of medicine and his study under Plato. From the study of medicine he early acquired a liking for natural science. Its technique produced in him a respect for facts, an attitude of mind that was quite essential for his later scientific investigations. From Plato he acquired his zest for philosophy, particularly in its moral aspects. His relationship with Alexander was especially fortunate because it enabled him to assemble a great multitude of facts that could not otherwise be obtained.

In the course of his various expeditions Alexander often had a regular corps of men at work gathering materials for his scholar friend. Like Plato, Aristotle was an aristocrat, and naturally this was reflected in his political theories.

**Writings and Philosophy.** The works of Aristotle include some 140 different titles, about 40 of these being extant. All told, his writings constitute a regular encyclopedia and are an index to the knowledge of the 4th century B.C. Disregarding the titles under which he published them, we shall here mention only his most important works according to the titles by which they are best known. His writings on logic appear in *Organon*; on natural history in *Physics*; on philosophy, or what he called first principles, in *Metaphysics*; on ethics in *Nicomachean Ethics* and *Eudemian Ethics*, and on politics and social questions in *Politics*.

**Logic.** A few rudimentary concepts in logic had been formed previous to Aristotle's time; but it was to this master mind that credit must be given for having first definitely organized and formulated its principles. Although Aristotle used induction to some extent it is for his work in deductive logic that he is famous. In fact the old formal deductive logic is often known as Aristotelian logic. He not only worked out the principles and divisions of classification but is responsible for having perfected the syllogism. So complete was his treatment of its various moods and figures that throughout the centuries few improvements have been made on it.

**Cosmology and Physics.** The picture which Aristotle sketched of the heavens is interesting not because of its accuracy or its scientific validity but because of its influence on thought in such matters. At the outermost edge are the fixed stars and above them are the highest vaults of heaven. The earth is at the center, and between it and the fixed stars are the various planets. The movement of the highest vault is circular, this being the most perfect form of motion; but the parts of the earth, being farthest from the prime mover, are forced to pursue rectilinear motion. It is quite apparent that Aristotle was too greatly influenced by teleological conception in his theory of the heavens.

**Metaphysics.** Here Aristotle considered the various conceptions of causation and from them worked out the relationship between form and matter, the keynote to his philosophy. He distinguished between four different types of causation: material, formal, efficient and final. The material cause is found in the substance of the thing, the matter without which it could not be; the formal cause is found in the idea, that which gives it its shape or form; the efficient cause is found in the forces that have brought it into being, the preceding events with which it is immediately connected; and the final cause is found in the purpose for its existence, the teleological factor. Reducing the latter three to but one principle, there is left the relationship between form and matter to be worked out. In his statement of this relationship

Aristotle differed from PLATO. Whereas for Plato the idea is real, for Aristotle it exists only in and through matter. The universal exists in the thing and the thing through the universal. Form is realized matter and matter is unrealized form. Matter is form in its possibilities, and form is matter in its actuality. Reality consists of matter becoming form, or the thing realizing its essence. Nature presents a hierarchical series in which the actualities of one stage are but the possibilities for another. At the top of this order is the unmoved mover or the completely realized form. God is perfect, for he possesses no unrealized possibilities; he is complete actuality and therefore immaterial.

**Psychology.** Man differs from the other animals in that he possesses a rational soul. With other animals he shares a sensitive and a vegetative soul. From these three souls are derived the three main divisions of self: the intellect from the rational, the feelings and emotions from the sensitive, and the appetites and desires or will from the vegetative. Aristotle also made a distinction between the passive and the active intellect, the former being of natural origin along with the other faculties. It is to the active intellect alone, impersonal in character and mysterious in its origin, to which he attributed immortality.

**Ethics and Politics.** In his ethics Aristotle showed himself a good Greek. Here the aesthetic element predominates. The feeling for harmony and proportion is displayed in his doctrine of the golden mean. Virtue is a mean between extremes. For the intellect it is found in well-being and for the will in well-doing. At all times one should live happily and wisely. Monarchy was regarded as the best form of government; but Aristotle realized that it very easily degenerated into tyranny. Likewise an aristocracy has a tendency to become an oligarchy, while democracy is a perverted form of government. Man is by nature a political animal, for it is through the state that he best realizes his rationality. Slavery was recognized as a legitimate institution, for some men are by nature slaves. Some are born to rule and others to serve. The institution of private property was also recognized by Aristotle.

**Position and Estimate.** Perhaps no one thinker has exerted a greater influence on posterity than Aristotle. During the Middle Ages he became the authority whose only competitor was the Bible. Most medieval theology (see SCHOLASTICISM) was but an attempt to square the Bible with Aristotle. In logic the deductive method was accepted until the beginning of the modern period, and in biological science the method of classification held sway until the concept of evolution forced more functional interpretations. Although Aristotle made much of the idea of development, his fixed goal prevented its taking the form of an evolutionary idea. His logic is essentially structuralistic in character, and in so far as thought has a tendency to influence society, it has given rise to a structural rather than a functional order.

R. N. B.

**ARITHMETIC.** The word has had two distinct meanings. It comes from two Greek words, *arithmos*, number and *tekhnē*, art. Originally it referred to a subject taught in the ancient schools of Greece (see PYTHAGORAS) as the art or theory of numbers, having no direct connection with computation, which was then called *logistike*. These distinct branches went by different names for many centuries, and this is still the case in certain countries. As early as the 10th century another name came into use in Europe. A mathematician in Bagdad, named al-Khowârizmî, wrote a book about 825 on computing with Hindu numerals, apparently the origin of those which we commonly use to-day. The book was translated into Latin as the *Liber Algorismi* (Book of al-Khowârizmî), and arithmetics giving the methods of computing there suggested were called the books of algorism. There have been numerous other names besides these.

**Names for Arithmetic.** We therefore have three names for the theory or practice of numbers, (1) arithmetic, (2) logistic, (3) algorism, all kept quite separate until books began to be printed, about 1450. The tendency then was to take the most aristocratic of these names, *arithmetic*, and apply it to all books relating to either the theory of numbers or the art of calculation. Since about 1500 the word arithmetic has often been used in this way, and in English-speaking countries this is generally the case at present. See NUMBERS, THEORY OF.

**Range of and Extent of Work.** Taking the term in this sense it is supposed to cover the following topics:

1. Counting, number names. The limit depends upon the school year in which the subject is taught, and in modern schools it is made to depend as far as possible upon the immediate needs of children until the last years of the elementary grades.

2. Numerals. The common system, incorrectly called the Arabic, and the Roman numerals as far as the pupil has need of them in connection with (a) the clock, (b) paragraph or chapter numbers, and (c) dates. Numbers like DCLXIX are coming to be looked upon as useless in the elementary school, having only an interest for Latin scholars.

3. The fundamental operations with whole numbers. The number has varied with educational fashions. Sometimes it has included counting; progressions, elementary series, usually two or three kinds; roots, square and cube; fractions, and other topics. At present the term has little importance, but it may be said to include only addition, subtraction, multiplication and division. These subjects are taught as the pupils' needs and capacity develop, but in the United States the four operations are usually fairly well understood by the end of the fourth school year.

4. Common fractions, a term used to distinguish fractions written like  $\frac{3}{4}$  from the SEXAGESIMAL FRACTIONS largely used by scientists in the late Greek civilization and the Middle Ages. When these fractions became so cumbersome that they could not be readily

used, as in cases like  $\frac{14767}{40321}$ , which were not at all uncommon in printed books of the 16th century, the decimal fraction (*see* DECIMALS) was invented, in the 16th century, and has slowly driven out all but the simplest common fractions.

5. The operations with common fractions are the same as those with integers, but the modern tendency is to limit the work in the schools to cases that are likely to arise in actual daily life. The relative values of the operations may be summarized as follows: Commonly needed, halves, thirds, fourths, eighths, sixteenths. Occasionally needed, other denominators to twelfths. Needed for addition or subtraction,  $\frac{1}{2}$ ,  $\frac{1}{4}$ ,  $\frac{3}{4}$ ,  $\frac{1}{8}$ ,  $\frac{3}{8}$ ,  $\frac{5}{8}$ ,  $\frac{7}{8}$ . Needed for multipliers, any with denominators to 12. Needed for divisors,  $\frac{1}{2}$ ,  $\frac{1}{4}$ . Mixed numbers, like  $2\frac{1}{2}$ . Needed as above in addition, subtraction and multiplication, but too rarely used in division to be generally taught. Cases like  $\frac{2}{7} + \frac{9}{11}$ ,  $\frac{5}{9} \times \frac{6}{13}$  and  $2\frac{2}{7} \div 1\frac{3}{8}$  are obsolete.

In technical work of certain kinds other fractions may enter, but in the general work of the elementary school they are of no direct value.

6. Denominate numbers. This subject, often under the title of Compound Numbers, has happily been greatly simplified in recent years. The tables of measures are now generally limited to the prospective needs of most children, the technical needs of the various trades being met if and when the pupil enters one or more of them. The relative values may be summarized as follows: Units of special value, (1) Length: inch, foot, yard, rod (rural), mile. (2) Weight: ounce, pound, (short) ton. (3) Area: square inch, square yard, square mile, acre. (4) Volume, capacity: cubic inch, foot and yard; pint, quart, gallon, peck, bushel. (5) Time: second, minute, hour, day, week, month, year, century. (6) Counting: dozen. (7) Metric units: meter, kilometer, gram, kilogram. Meaning of milli-, centi-, kilo-. *See* METRIC SYSTEM.

Units of value too slight to be generally required include special weights, such as troy; apothecary's, now happily omitted in the elementary schools; long ton; surveyor's link and chain; square rod, section and township except where commonly used; gill; score, and such metric units, as deciliter and myriameter, as are not commonly mentioned in connection with sports and simple science. Compound forms in addition and subtraction, limited to feet + inches, yards + inches, pounds + ounces, tons + pounds, hours + minutes. Modern business uses  $2\frac{1}{2}$  bu. instead of 2 bu. 2 pk. and never uses 4 yd. 2 ft. 8 in. Compound forms are commonly used in such multiplications as  $2 \times 3$  ft. 8 in. but not in cases like  $4 \times 7$  cu. ft. 524 cu. in. They are used in such divisions as are needed in finding  $\frac{1}{4}$  of 6 ft. 8 in. but not frequently enough in more difficult cases to warrant teaching them. Cases like  $18$  ft.  $7$  in.  $\div 2$  ft.  $9$  in. are too rarely used to be commonly taught.

7. Decimals are now usually taught with relation to dollars and cents. The operations with them are less important than is usually thought. Cases like  $2.74 +$

$0.6 + 10.0873$ , where the number of decimal places differ, are of little practical value, and similarly for  $2.987 \times 5.0762$  or  $52.07 \div 0.298$ . They are simply puzzles to keep pupils occupied. Fortunately they are disappearing from our elementary schools. If the work were confined to real cases involving money numbers, and to multiplying by numbers like 0.06 or 1.25, needed in practical cases in percentage, the needs of all but a relatively small number preparing for technical courses would be met. Indeed, any preparation of this kind in the elementary schools would be forgotten before it could be put into real use.

8. Percentage is a subject which, like decimals, has been much overvalued. What people generally need to know is how to find a given per cent of a number, as interest for periods of time commonly used, commission or discounts; to find what per cent one number is of another, in baseball scores, for example; and, much less often, the number of which a given number is a given per cent. It is desirable to limit the work to these features and, as always in teaching, to relate it to children's interests.

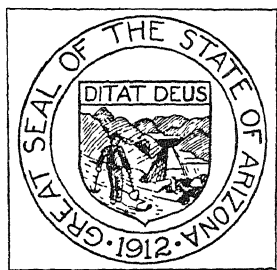
**Socializing Tendencies.** The range of problems in arithmetic covers all types of human endeavor. All that the schools are expected to do is to apply necessary computation to such social needs of people in general as the child may be expected to readily comprehend, and, as far as reasonable, which naturally arise in his daily life. The games of early childhood; the make-believe activities of later school years, as camping trips and travel; the manual activities provided by the school; and, finally, the great industries of our country and the knowledge required in simple purchases, in having a bank account, in relation to the government, as in expenses and taxes, and particularly in relation to the home, as rent, budget and savings,—these are coming to be recognized as the proper material for the problems of the school. D. E. S.

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**ARIUS**, the famous heresiarch from whom Arianism received its name. Of his birth and early training little is known. He emerges as a disciple of that speculative school of theology which included Paul of Samosata, bishop of Antioch, who had been excommunicated in 269, and Lucian of Antioch, a famous Biblical scholar. He was made presbyter in 313, by Achillas, bishop of Alexandria. Tall of stature, grave in demeanor, faithful in his duties and blameless in his private life, Arius came into conflict with the patriarch Alexander, solely as a result of his theological views. At a council, the Arians were asked, "could Jesus become bad," and they replied "yes, he can," a result of their logic which horrified the orthodox. The opponent of Arius was ATHANASIOS. At the Council of Nicaea, 325, so bitter were the personalities that when Arius indulged in gestures, he was accused of being a snake in disguise. Defeated at Nicaea Arius still exercised great influ-

ence and he convinced Constantine of his essential orthodoxy. Athanasius was ordered by the emperor to reconcile Arius with Christ, but refused. In 336, however, Arius persuaded the emperor to issue a similar order to Alexander, patriarch of Constantinople. On the Saturday preceding this reconciliation with the Church, Arius was suddenly seized by an appalling illness. His friends declared that the orthodox had poisoned him, but his enemies interpreted the event as a judgment of God. He died in 336.

**ARIZONA**, one of the southwestern states of the United States popularly called the "Apache State." It is situated between  $31^{\circ} 20'$  and  $37^{\circ}$  N. lat. and  $109^{\circ} 2'$  and  $114^{\circ} 45'$  W. long. On the north it is bounded by Utah, on the east by New Mexico, on the south by Mexico, and on the west by California and Nevada. The Colorado River separates it from California and partially from Nevada. Arizona comprises an area of 113,956 sq. mi., inclusive of 146 sq. mi. of water surface. The state is about 350 mi. square and in size ranks fifth among the states of the Union.



ARIZONA STATE SEAL

**Surface Features.** Arizona is a complex of plateaus, mountains and deserts. Its many degrees of elevation vary from 100 ft.

above sea level where the Colorado River crosses into Mexico, to 12,611 ft. at the summit of San Francisco peak near Flagstaff. The mean altitude is 4,100 ft. Its topographic regions include parts of the Colorado Plateaus, Sonoran Desert and Mexican Highlands.

The Colorado Plateaus are a continuation of the plateaus of Utah and western Colorado and occupy fully one-fifth of the state. The elevations range from 5,000 ft. up. Some are table-like mesas protruding above the plain, others rise in series of terraces, and a few are basin-like, enclosed by in-facing cliffs. They differ in temperature, rainfall and the extent to which they are cut by canyons.

The most spectacular feature of this province is the Grand Canyon of the Colorado River, which cuts off a rectangular section of the northwestern part of the state. *See GRAND CANYON NATIONAL PARK.* North of the canyon is a series of plateau terraces descending from east to west like huge steps, each step being about 1,000 ft. high. They are successively the Kaibab, 9,000 ft. high and 35 mi. wide, bordered on the east by the Marble Gorge of the Grand Canyon and on the west by an almost vertical cliff; the Kanab, ending at the west with the Toroweap escarpment; the Umkaret which has some 160 volcanic cones, and Mt. Trumbull rising nearly 2,000 ft. above it; and Shivwits, separated from the Umkaret by the Hurricane Ledge and terminating at the west with the Grand Wash escarpment.

South of the Grand Canyon is the San Francisco Plateau, an area of 2,000 to 3,000 sq. mi. covered by

lava flows and dotted with several hundred volcanic cones. Its general level is 5,000 to 7,000 ft. above sea level. Directly north of Flagstaff the San Francisco Mountains rise 5,000 ft. above this level.

In the northeastern part of the state is the Navajo section which takes its name from the Indian reservation. It is noted for the Echo Cliffs which lie immediately east of the Grand Canyon; for the Black Mesa, a tableland in northern Navajo and Apache counties, 60 mi. in diameter with out-facing cliffs 2,000 ft. high and for the PAINTED DESERT east of the Little Colorado River. The latter is famed for its startling display of red, yellow, white and chocolate colorings.

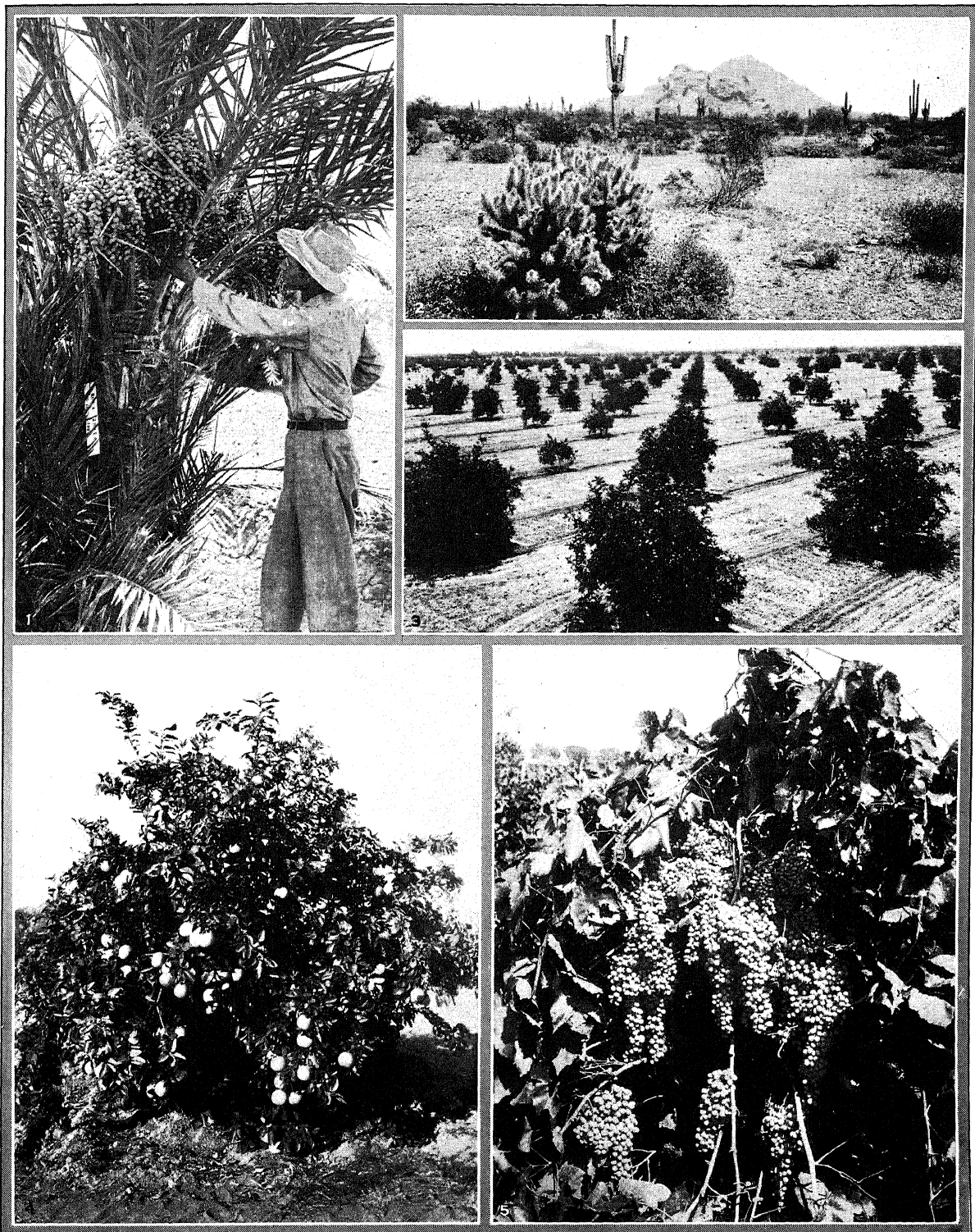
The Sonoran Desert as a whole includes the Mohave Desert of California and the southwestern portion of Arizona which is locally known as the Gila Desert. The latter consists of widely separated, short mountain ranges in desert plains and is similar to the Great Basin of Nevada except that the altitudes are lower and the ranges are smaller. More than half of the Gila Desert is below 2,000 ft. and a considerable area is below 1,000 ft. Its level declines gradually toward the Gulf of California. The lower course of the Gila River flows across it and joins the Colorado at Yuma.

East of the Sonoran Desert, in southeastern Arizona, is a section of the Mexican Highlands which extend eastward into New Mexico and southward into Mexico. This province in Arizona includes also the ranges north of the Gila Desert which form the water parting between the Colorado and Gila rivers. The highlands are a combination of basins, called bolsons, and ranges similar to those of the Gila desert but distinguished therefrom by higher altitudes, less desert region, larger mountains and a greater number of rivers. Intermediate between these highlands and the extreme desert to the west is found the most productive agricultural section of the state. The chief tributaries of the Gila, the Verde, Salt, Santa Cruz and San Pedro rivers, supply water to irrigate extensive valley areas.

**Climate.** Because of its great area, diversity of surface and differences in elevation above sea level, Arizona has a wide range of local climates, characterized generally by dryness and clearness. The mean annual temperature is  $61.8^{\circ}$  F., ranging from  $45^{\circ}$  F. in the northern plateau region, with an elevation of 5,000 ft. and upwards, to  $69.7^{\circ}$  F. at Phoenix in the plains of south central Arizona at about 1,000 ft. altitude. Phoenix has an average of  $51.2^{\circ}$  F. for January and  $89.8^{\circ}$  F. for July. During the period, 1897-1930, the highest temperature recorded in the state was  $127^{\circ}$  F. and the lowest  $-33^{\circ}$  F. The average annual precipitation is 13.8 in., decreasing from 20 in. in the northern plateau to 7.8 in. at Phoenix. The hottest weather and the least rainfall occur in the lower Gila Valley, where the maximum temperature approaches  $130^{\circ}$  F., with a mean for July of  $98^{\circ}$  F. and the annual rainfall is from about 2 to 5 in.

**Forests and Parks.** Sparse growths of juniper, pinyon and several species of evergreen oak are found above the desert slopes and below the evergreen forests

# ARIZONA



1, 2, 3, 5, COURTESY BUREAU OF RECLAMATION; 4, PHOTO MCCULLOCH BROS., PHOENIX

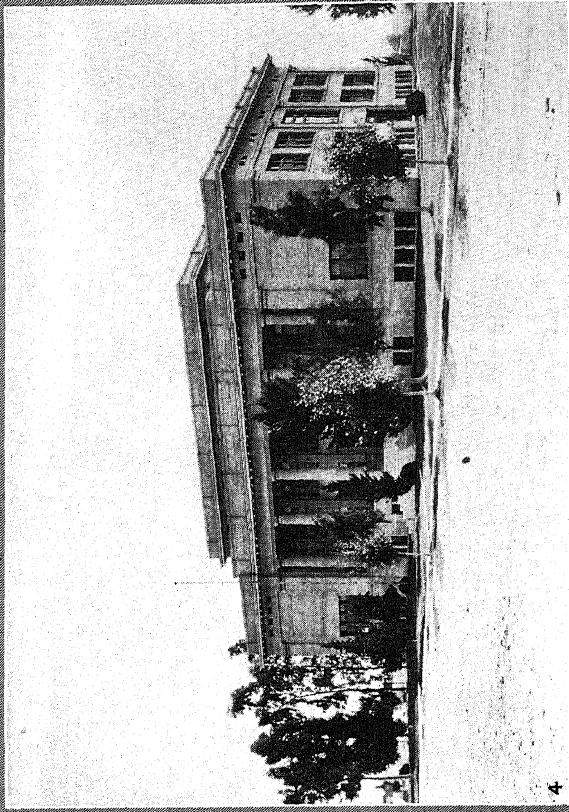
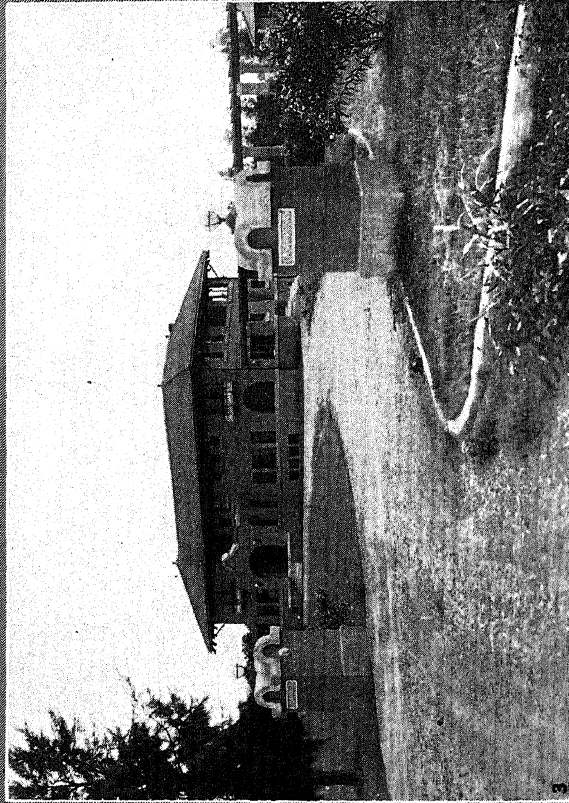
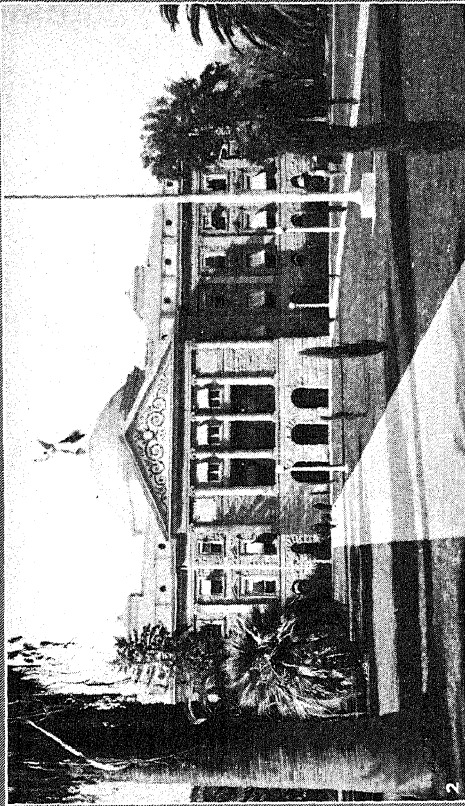
## FRUIT GROWING ON IRRIGATED LAND IN ARIZONA

1. Nine-year-old Remta date palm on the State Experiment Farm. 2. Unirrigated land in the Salt River Project, with Camel Back Mountain in the distance. 3. Grapefruit orchard

in the Yuma Project. 4. Orange tree. Citrus growing is a rapidly increasing industry in Arizona. 5. Vine laden with Thompson Seedless grapes in the Salt River Project.



# ARIZONA



1, COURTESY PHOENIX CHAMBER OF COMMERCE, PHOTO McCULLOCH BROS.; 2, PUTNAM PHOTO; 3, 4, U. S. BUREAU OF RECLAMATION

## INSTITUTIONAL, GOVERNMENT AND DOMESTIC BUILDINGS IN ARIZONA

1. Mission of San Xavier del Bac. 2. State Capitol, Phoenix.
3. Ranch home in the district irrigated by the Salt River Project. 4. Union High School, Yuma.





# ARIZONA

Area, 113,956 sq. m.  
Pop. 435,573

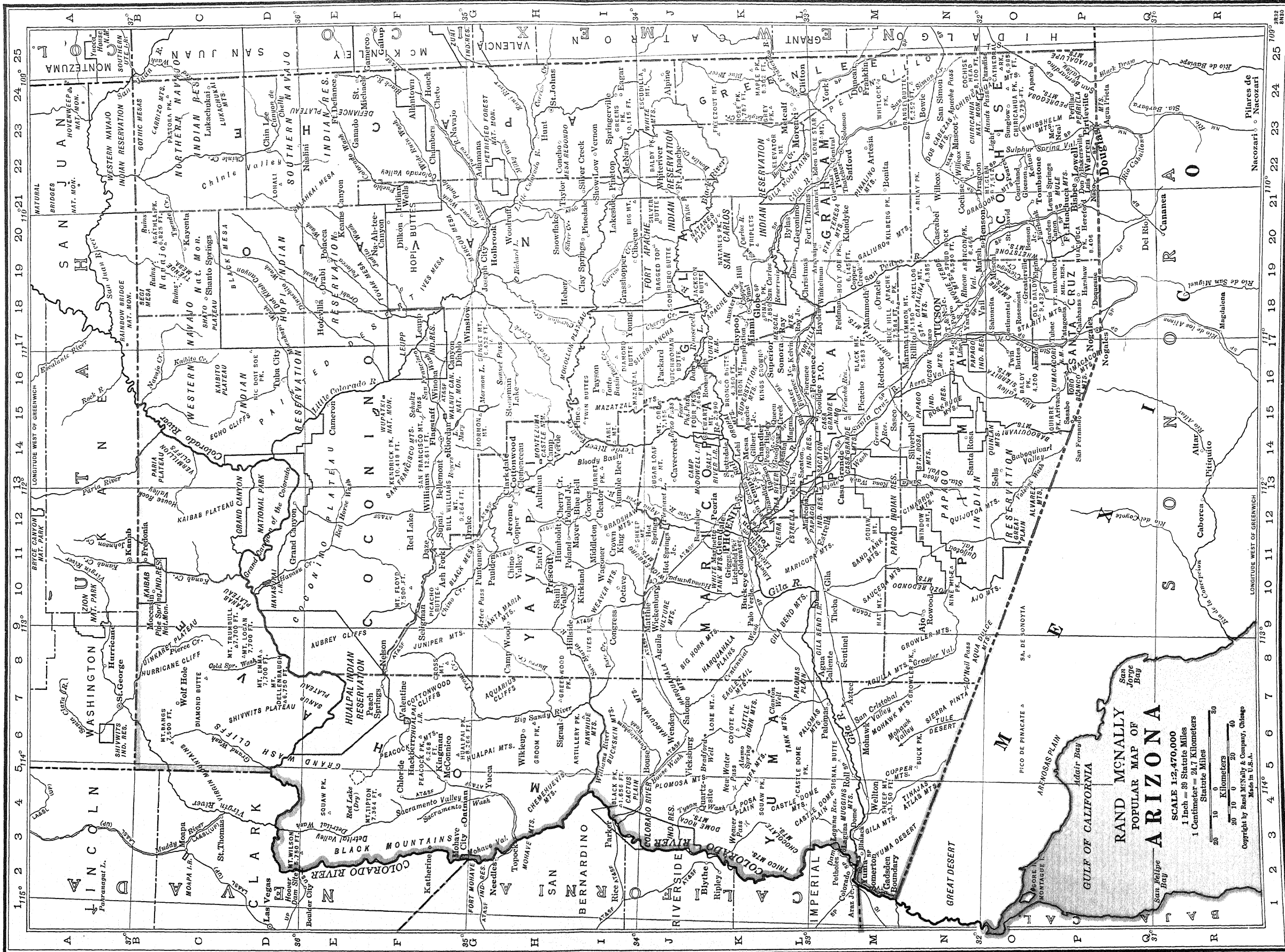
## PRINCIPAL CITIES

### Pop.—Thousands

- 8 Bisbee... P 23
- 1 Buckeye... K 11
- 1 Casa Grande... L 14
- 1 Chandler... K 14
- 1 Claypool... K 18
- 1 Clifton... L 24
- 2 Cottonwood... H 13
- 10 Douglas... P 23
- 4 Flagstaff... G 14
- 1 Florence... L 15
- 1 Ft. Huachuca... P 20
- 4 Glendale... K 12
- 4 Globe... K 18
- 4 Holbrook... G 20
- 4 Jerome... H 12
- 4 Mesa... K 14
- 4 Miami... K 17
- 4 Nogales... L 17
- 4 Phoenix... K 13
- 4 Pima... L 22
- 4 Pirtleville... P 23
- 4 Prescott... H 11
- 4 Safford... M 22
- 4 Sonora... L 17
- 4 Tempe... K 13
- 32 Tucson... N 17
- 4 Williams... F 12
- 4 Winslow... G 18
- 4 Yuma... M 2

### Pop.—Hundreds

- 1 Ashurst... L 21
- 1 Bakerville... P 22
- 1 Benson... O 20
- 1 Blackwater... L 15
- 1 Black... M 3
- 1 Blue Bell... L 12
- 1 Bylas... L 21
- 1 Cherry Creek... H 12
- 1 Chino Valley... H 11
- 6 Clemenceau... H 13
- 9 Coolidge... L 15
- 1 Copper... H 11
- 1 Copper Hill... K 18
- 1 Dome... M 3
- 2 Duquesne... P 18
- 1 Estrella... L 11
- 1 Fort Apache... K 18
- 1 Geronimo... L 21
- 1 Gilbert... K 14
- 1 Glenbar... L 22
- 1 Inspiration... K 17
- 1 Joseph Cy. G... 20
- 1 Lakeside... L 21
- 1 Octave... L 10
- 1 Perilla... P 23
- 1 Pinedale... L 23
- 1 Red Lake... F 12
- 1 Rowood... N 9
- 1 Sacaton... L 14
- 1 Saco... M 15
- 1 Skull Valley... H 10
- 1 Snowflake... H 21
- 1 Somerton... M 1
- 1 Taylor... H 21
- 1 Thatcher... L 22
- 1 Theba... L 9
- 1 Tolleson... K 12
- 1 Tombstone... O 21
- 1 Valentine... F 7
- 1 Wickenburg... J 10
- 1 Wilcox... N 22
- 1 Winkelman... L 18





of the higher mountains of southern Arizona and to some extent in the central northern portions. Cottonwood, ash, sycamore, willow, walnut and cherry grow in thickets in the canyons. Throughout the state above 6,000 to 7,000 ft., with the exception of the vicinity of the San Francisco Peaks, is an evergreen coniferous forest. The heaviest growth extends from south of the San Francisco Peaks southeast to the border of New Mexico. Western yellow pine is the principal tree up to an altitude of 7,500 to 9,000 ft. Above this Douglas fir and Engelmann spruce are found in heavy stands and also some deciduous species, chiefly oak and poplar. Approximately six-tenths of the area of Arizona is under Federal ownership and is devoted to national forests, national monuments, Indian reservations and to Grand Canyon National Park. The nine National Forests—Apache, Coconino, Coronado, Crook, Kaibab, Prescott, Sitgreaves, Tonto, and Tusayan—have an area of 11,371,341 acres. They are well developed for camping and other recreational uses and contain extensive state and Federal game preserves, with deer, elk, mountain sheep, antelope, peccary, and also quail, turkey and other game birds. Of the nine national monuments CHIRICAHUA, SUNSET CRATER, TONTO and WALNUT CANYON are within national forests and are administered by the Department of Agriculture; PIPE SPRING, NAVAJO, WUPATKI, CASA GRANDE, TUMACACORI, MONTEZUMA CASTLE and the PETRIFIED FOREST are administered by the National Park Service.

**Minerals and Mining.** Since early territorial days mining has been the outstanding industry. About 1860 valuable finds of placer gold were made along the lower courses of the Colorado and the Gila, and about 1880 rich lodes were discovered at Tombstone. With the development of the great mines at Bisbee and in other districts as around Globe, Morenci and Jerome, Arizona rose during the 30 years ending with 1910 to foremost rank as a producer of copper.

With mineral products amounting to \$157,959,792 in 1929, Arizona stood eighth among the states, ranking first in copper, second in vanadium and asbestos, third in molybdenum, fourth in silver and tungsten and fifth in gold.

The principal products in order of value were copper, 830,628,411 lbs., \$146,190,600; gold, 202,318 oz., \$4,182,287; silver, 7,543,283 oz., \$4,020,570; lead, 8,027 tons, \$1,011,410; and asbestos, \$320,225. Many other minerals of less importance are mined, as mercury, wolframite, onyx marble, alunite, and various gem stones, including turquoise, peridot and garnet.

During 1929 138 mines and quarries were operated, employing 18,134 persons who received \$32,323,957 in salaries and wages.

**Soil.** In the river valleys of Arizona, particularly those of the Verde and the lower Colorado, a fine sediment is found. This forms the most fertile soil occurring in the state. It is essentially very rich although rather deficient in nitrogen and vegetable mold. Throughout the south central part of the state, there are sandy soil formations varying from heavy

"adobe" to light loams. Although in many areas alkali has so permeated the soil that it is unreclaimable, lack of water is the greatest obstacle to the raising of crops in Arizona.

**Agriculture.** Cotton, alfalfa and vegetables are the leading farm products. In 1930 10,526,627 ac. or 14.5% of the total land area was in farms, 14,173 in number, with an average size per farm of 742.7 ac. and an average value per acre of \$17.50. Of the farm area 648,692 ac. or 6% was crop land and 9,681,532 or 92% was pasture land. The total value of farm property was \$243,457,579, of which \$184,230,656 was represented by land and buildings; \$10,413,814, by implements and machinery, and \$48,813,109, by domestic animals.

According to the census of 1930 Arizona produced in 1929 field crops to the value of \$32,366,573, ranking fortieth among the states. It stood second in lettuce and cantaloupes, third in lemons, fourth in grapefruit and fifth in oranges. The chief crop was cotton, 149,488 bales valued at \$15,755,520, together with cottonseed, 76,231 tons, \$1,982,006. Other important crops were hay and forage, 302,214 tons, \$5,745,444, mostly alfalfa; vegetables, \$4,977,131; grains, \$2,061,808, and fruits and nuts, \$1,844,664. The vegetables included lettuce, \$2,658,191, and muskmelons, \$1,047,956. The grains included wheat, 348,745 bu.; corn, 243,004 bu., and barley, 235,072 bu. Among the chief fruits were grapefruit, 364,182 boxes; oranges, 137,371 boxes; lemons, 12,818 boxes, and grapes, 3,913,284 lbs. Farm products sold by co-operative marketing rose from \$394,508 in 1919 to \$2,952,999 in 1929. Farm machinery and equipment in 1930 included 9,916 automobiles, 3,062 motor trucks, 2,558 tractors, 2,054 electric motors, and 3,095 stationary gas engines.

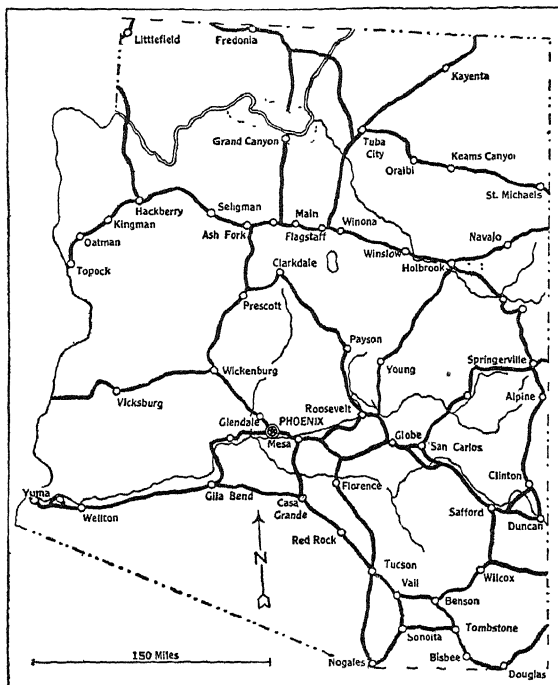
**Irrigation.** About nine-tenths of the field crops of the state are produced on irrigated lands. Irrigation is most extensively developed in the drainage basin of the Gila River and its tributaries, chiefly in Maricopa Co., containing two-thirds of the irrigated acreage, but also in Graham, Pima, Pinal and Yuma counties which contain most of the remainder. In 1930 the irrigated farms comprised 60% of the number and 81% of the value of all farms in Arizona. The proportion actually irrigated was 5.5% of all land in farms and 0.8% of the land area of the state.

According to the Census of 1930 the total number of irrigated farms was 8,523, with an aggregate area of 2,983,784 ac., of which 575,590 ac. were irrigated. Including land and buildings the value of all irrigated farms was \$149,154,077, or an average of \$49.99 per ac. The total investment in irrigation enterprises to 1930 was \$73,328,197 and the average cost of maintenance and operation for 1929 was \$4.57 per ac.

**Animal Industry.** Cattle-raising and sheep-raising are the principal livestock interests. According to the census of 1930, Arizona ranked thirty-sixth among the states in total value, \$48,813,109, of domestic animals on farms. Among these were: cattle, 695,118, valued at \$33,670,800; sheep, 1,339,905,

\$9,084,649; horses, 79,699, \$3,220,477; mules, 11,310, \$672,455; goats, 290,948, \$1,077,456, and swine, 23,782, \$289,765.

Of the cows on farms, 347,487 were kept mainly for beef production and 41,380 mainly for milk production. In 1929 21,004,609 gals. of milk were produced; the value of dairy products sold was \$4,933,396. The sheep industry yielded 5,451,415 lbs. of wool valued at \$1,308,340. From goats were clipped mohair and kid hair to the value of \$296,366. The poultry grown, mostly chickens, amounted to a total value of \$1,176,775; the chickens sold, to \$402,284. Of 5,081,086 doz. chicken eggs produced, valued at \$1,954,444, 3,804,565 doz., with a value of \$1,466,313,



ARIZONA STATE ROADS

were sold. Honey, amounting to 1,613,482 lbs. valued at \$93,728, was produced from 38,417 hives.

**Fisheries.** There are no commercial fisheries in the state, but the various streams and lakes, especially those in the national forests, offer good fishing to sportsmen. The state operates three hatcheries. In 1930, \$15,688.95 was expended and the output was 3,036,400 trout, 5,000 bass, and 31,000 other game fish; in addition, the United States Bureau of Fisheries distributed 1,500,000 trout in various streams in the national forests. The work of the state hatcheries is supported from fishing license fees.

**Transportation.** The lower reaches of the Colorado River, the western boundary of the state, are its only navigable waters. Railroad facilities are provided by two transcontinental lines, the Santa Fé and the Southern Pacific railways. They have an interconnection and several branches within the state. In 1930 the aggregate railway mileage was 2,494.

The total highway mileage on Jan. 1, 1930 was 25,881, including 3,597 mi. of surfaced roads and 1,685 mi. of state highways. The total expenditure for highways during 1929 was \$6,381,294, of which the state paid \$4,385,501 and county and local governments \$1,995,793. The state gasoline tax produced a gross revenue of \$2,670,019 in 1930. Motor vehicle registrations during 1930 were 110,525, compared with 68,029 in 1925. The growth of trucking facilities is indicated by the increase in motor truck registrations from 8,231 in 1925 to 12,045 in 1930. During the same period, the number of buses in operation increased from 214 to 608, or about 185%.

**Manufactures.** Mineral, agricultural and forest resources form the basis of the state's factory industries.

According to the Census of 1930 Arizona with manufactures for 1929 valued at \$200,002,217 stood fortieth among the states. Its 348 establishments gave employment to 1,659 officers and employees, who received \$4,268,292 in salaries and to 10,550 wage earners, who were paid \$15,074,528 in wages. These factories used a total of 180,637 horse power, expended \$8,195,895 for fuel and power, and \$159,517,700 for material and supplies, and added by the process of manufacture \$32,288,622 to the value of their output.

The outstanding factory industry is the smelting and refining of copper, the output of which, valued at \$156,671,668, represented 78% of the total manufactures of the state. Among the chief minor manufactures were meat products valued at \$5,933,012; lumber and timber products, \$4,419,456; cottonseed oil, cake and meal, \$3,459,915; bread and bakery products, \$2,687,905, and manufactured ice, \$2,176,742. The output of the printing and publishing establishments was valued at \$4,268,475. The chief industrial center is Phoenix, with products valued at \$13,572,380.

**Commerce.** According to the census of 1930, there were in 1929 358 wholesaling establishments in Arizona, with total sales of \$97,554,221. They gave full-time employment to 3,554 men and women, whose salaries for the year aggregated \$23,650,325. The chief wholesaling center is Phoenix.

The sales of the 5,044 retail stores amount to \$192,418,746. Sales per store averaged \$38,148; the fourth highest in the United States. Retail sales per capita were \$441.76.

#### CHIEF RETAIL DISTRIBUTING GROUPS

Group	No. of Stores	Sales	% of Total
Automotive .....	1,141	\$46,316,483	24.07
General Mdsc. ....	589	44,099,698	22.92
Foods ....	1,380	36,468,229	18.95
Lumber & Bldg. ....	184	15,121,433	7.86
All other stores ....	1,750	50,412,903	26.20
Total, all stores ...	5,044	\$192,418,746	100.00

**Finance and Banking.** The assessed value of all real and personal property in 1929 was \$700,890,801. On June 30, 1930 the total bonded debt was \$1,683,-

275 against which there were sinking funds of \$56,544. Total revenue receipts in 1928 were \$9,627,493 and total expenditures, \$8,792,602. The chief sources of revenue were property and special taxes, \$6,161,280, and licenses, including motor vehicle taxes, \$1,829,130. The principal expenditures were for highways, \$2,977,324, educational aid, \$1,913,267, permanent improvements, \$1,902,140, and debt service, \$96,275.

There were 71 banks in Arizona in 1930, of which 13 were national banks and 58 trust companies and state banks. Their aggregate capital was \$5,795,400, whereas surplus and undivided profits were \$5,918,000. Their total resources were \$97,694,000; loans and discounts including rediscounts were \$46,495,000. Demand and time deposits, including postal savings totaled \$80,774,000. Per capita demand and time deposits were \$184.00; per capita savings deposits \$71.06. The total savings of \$31,195,000 were owned by 77,967 depositors. National bank circulation in 1930 aggregated \$1,220,000.

**Government.** The legislative body consists of a senate composed of 19 members and a house of representatives of 46 members, all elected for terms of two years. They meet in biennial sessions, each limited in duration to 60 days. The executive department is headed by the governor who is elected for a term of two years with an annual salary of \$6,500. The veto power given to the governor does not extend to initiative and referendum measures approved by a majority of the qualified voters. The highest judicial power is vested in the supreme court consisting of three judges elected for terms of six years at salaries of \$5,000 per annum.

**Social Welfare Institutions.** The state insane asylum is at Phoenix. There is an industrial school for boys at Fort Grant and a school for girl juvenile offenders at Randolph. The Arizona Pioneers Home for the aged is located at Prescott. In 1929 the state legislature authorized a school for feeble-minded children to be erected near Mesa. The state penitentiary is at Florence.

**Education.** The first public school was opened at Tucson in 1869 by Augusta Brichta, and the first school established under a school law was opened in the same city four years later. Compulsory school attendance laws, first passed in 1899, require children from 8 to 16 years of age to go to school the full school year. In 1927-28 the 394 district elementary schools enrolled 78,339 pupils and 2,541 teachers. In the 54 high schools there were 10,724 pupils and 664 teachers.

The total number of persons from 5 to 20 years of age attending school in 1930 was 94,420, or 66.8% of the population included in the ages given, as compared to 59,496, or 56.4%, in 1920. The number of illiterates, 10 years of age and over, in 1930 was 33,969, or 10.1 % of the population; in 1920 it was 39,131, or 15.3%.

There are 20 Indian schools, the largest of which is maintained by the Federal Government. The state University of Arizona at Tucson is the principal institution of higher education. The two public normal

schools at Tempe and Flagstaff have the standing of teachers' colleges.

**Population.** In 1930 Arizona ranked forty-third among the states with a population of 435,573 or an average of 3.8 per square mile, an increase of 101,411 or 30.3% over 1920. The population rose from 9,658 in 1870 to 122,931 in 1900, 204,354 in 1910, and to 334,162 in 1920. In 1930 there were 264,378 or 60.7% whites, 114,173 or 26.2% Mexicans, 43,726 or 10% Indians, and 10,749 or 2.5% Negroes. Of the whites, 248,787 were native born and 15,591 were foreign born. The rural population was 285,717 or 65.6% of the total, an increase of 69,082 or 31.9% from 1920; the urban population was 149,856 or 34.4% of the total, an increase of 32,329 or 27.5% since 1920. There were in 1930 two cities with a population of 10,000 and upwards, Phoenix, 48,118, and Tucson, 32,506.

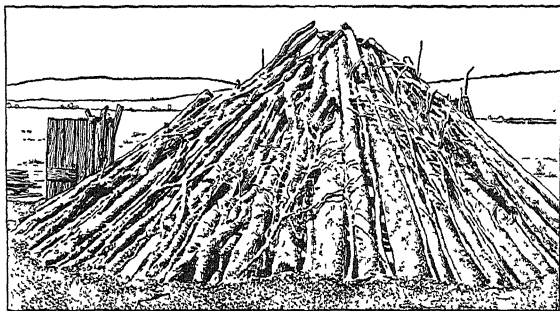
**Occupations.** In 1930 165,296 persons, or 37.9% of the population, were gainful workers 10 years old or older; 81.9% of these were males and 18.1% were females; 58.7% were native white; 5.6% foreign-born white; 3.6% Negro, and 32% other races. Among the chief occupations, with number of workers, were agriculture, 38,423; manufacturing, 34,704; trade, 19,809; domestic and personal service, 16,874; mining, 13,982, and professional service, 12,616.

## HISTORY

Archaeological exploration in Arizona has revealed the remains of prehistoric culture. Among the most remarkable are the Casa Grande structures, already in ruins when they were discovered in 1694 by Padre Eusebio Kino, now a Government reservation; the CLIFF DWELLINGS in the Navajo Reservation near Flagstaff and in other parts of the state, many of them 1,000 or more years old; and MONTEZUMA CASTLE on Beaver Creek. The region first became known to Europeans in the 16th century when Spaniards from Mexico explored northward in search of gold and silver. The first to enter Arizona was Marcos de Niza, a Franciscan friar, in 1539 at the head of an exploring party that wandered about in the southeastern part of the state. Members of Coronado's party, hoping to find the Seven Cities of Cibola, marched in 1541 through the Moqui country and reached the Grand Canyon. (See GRAND CANYON NATIONAL PARK.) Juan de Onate in 1604-05 traversed the state to the mouth of the Colorado. Padre Eusebio Kino started Jesuit missions at San Xavier del Bac in 1700 and at Guevavi in 1732. A presidio was established in 1752 at Tubac, but was removed in 1776 to a village of Indians on the site of the present Tucson, the first permanent white settlement. An almost constant state of war between the Spaniards and the Indians and between the Apaches and other Indians existed during the years of Spanish occupation. All the missionary settlements except Tubac and Tucson were finally abandoned. American traders and explorers began to penetrate Arizona during the first quarter of the 19th century, and were followed by a few settlers. In 1848 all that portion north of the Gila River was ceded to the



United States by Mexico as part of the conditions of the settlement of the MEXICAN WAR. The strip south of the Gila, the GADSDEN PURCHASE, was bought from Mexico in 1853 by the United States, which took possession in 1856. During the CIVIL WAR there were many Indian outbreaks as the American troops were withdrawn. Arizona Territory was organized at Navajo Springs Dec. 29, 1863. The capital at first Prescott, since 1889 has been Phoenix. Admission



COURTESY AMER MUS OF NATL HISTORY

NAVAJO HOUSE OF ARIZONA  
Partly dismantled

to statehood was granted Feb. 14, 1912. Arizona has had many boundary difficulties with adjoining states, while unsettled conditions and a border population produced, especially before its admission, some of the most lurid years in American frontier history. Its history since its admission to the Union has also been rather tumultuous. A bitter political struggle for the governorship in 1916 caused much high feeling. Industrial troubles led to serious strikes, and the deportation to New Mexico in July, 1917, of over 1,000 men belonging to the INDUSTRIAL WORKERS OF THE WORLD produced a critical situation.

In 1932 Arizona, since 1920 a Republican state, gave its three electoral votes to Franklin D. Roosevelt. Carl Hayden, Democrat, was returned to the Senate, and B. B. Moeur, also a Democrat, was elected to the governorship.

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**ARIZONA, UNIVERSITY OF**, at Tucson, Ariz., a coeducational state university, authorized in 1885 by the Arizona legislature, and opened in 1891. The university owns five experimental stations in various parts of Arizona, and in addition controls 600,000 acres of public lands allotted it by the United States and the State of Arizona. The productive funds in 1931 were \$132,666. The library contains 100,000 volumes. In 1931-32 there were 1,850 students, and a faculty of 149 headed by Pres. HOMER LEROY SHANTZ.

**ARK**, the name given to the vessel or boat which Noah, according to the Old Testament, constructed at the command of God for the purpose of saving himself and his family and two of each species of living creatures from the Deluge brought upon mankind because of their sinfulness and corruption. The

ark of Noah was box-like in appearance, made of gopher-wood, and three stories in height. The complete description of the ark and of the flood is found in Genesis 6:9-8:22. The ark is designated in the Bible only as a box (Hebrew, *tebah*), not as boat or ship. *Tebah* is the Hebrew word for chest, box, ark, coffin, etc., and was used also for the box in which Moses was placed after his birth in the Nile River.

Modern Biblical exegetes are inclined toward the view that the deluge was a purely local, although historical, occurrence, which destroyed the population of a limited primitive region. Subsequently, when these numerous small peoples migrated to other parts of the then known world, the tradition concerning this flood gradually became crystallized into its present form of a world-wide catastrophe which destroyed the whole of mankind, except Noah and the members of his family. This would account for the existence of a flood story among other primitive peoples. Indeed, the Babylonian story of the flood and the ark is remarkably similar to that contained in the Bible.

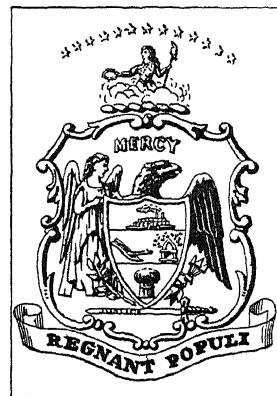
Ark is the designation given also to the cabinet or chest which contains the Scrolls of the Law, or Torah, used in the worship of synagogues and temples of to-day. Its full designation is Ark of the Law. It is generally believed to represent the Holy of Holies of the ancient Temple of Jerusalem. For this reason it is regarded as sacred, and the congregation always rises when the ark is opened and the sacred scrolls are either taken out or put back. The ark is placed in or against the synagogue or temple wall to the east, and at certain times in the course of the service the congregation faces in its direction.

A. SH.

**ARKADELPHIA**, a city and the county seat of Clark Co. in southwestern Arkansas, situated on the Ouachita River 66 mi. southwest of Little Rock. The Missouri Pacific Railroad and bus and truck lines serve the city. Cotton, corn and alfalfa are the main crops of the region; and flour, cotton seed oil products and feed are the chief manufactures. The city was founded in 1840. Arkadelphia is an educational center; Henderson State College, established in 1890, and Ouachita College are situated here. Pop. 1920, 3,311; 1930, 3,380.

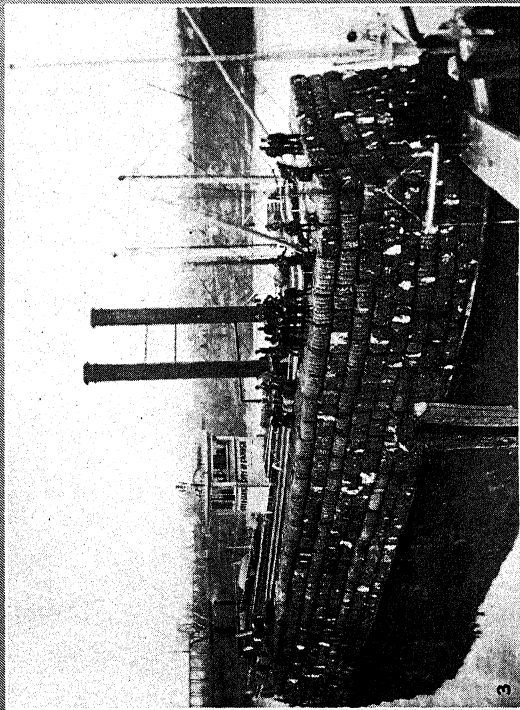
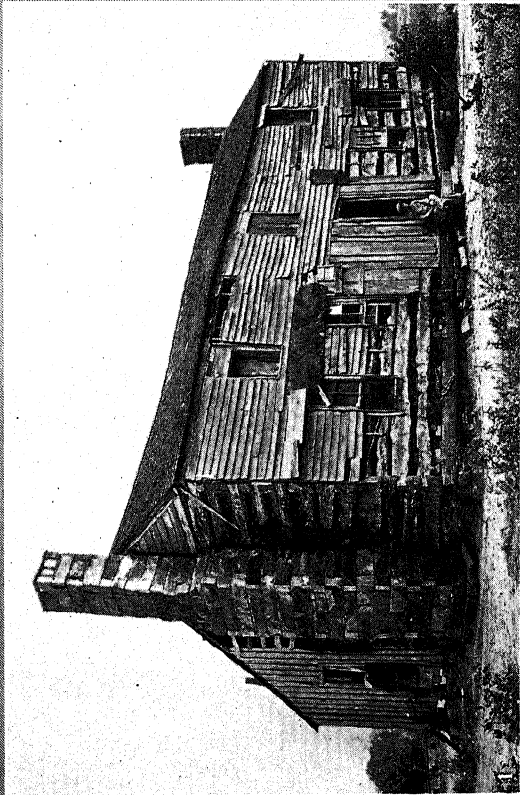
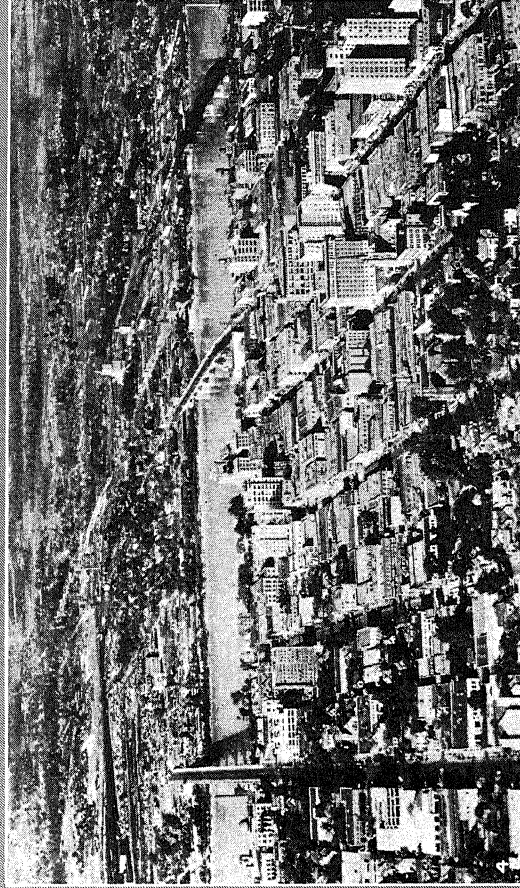
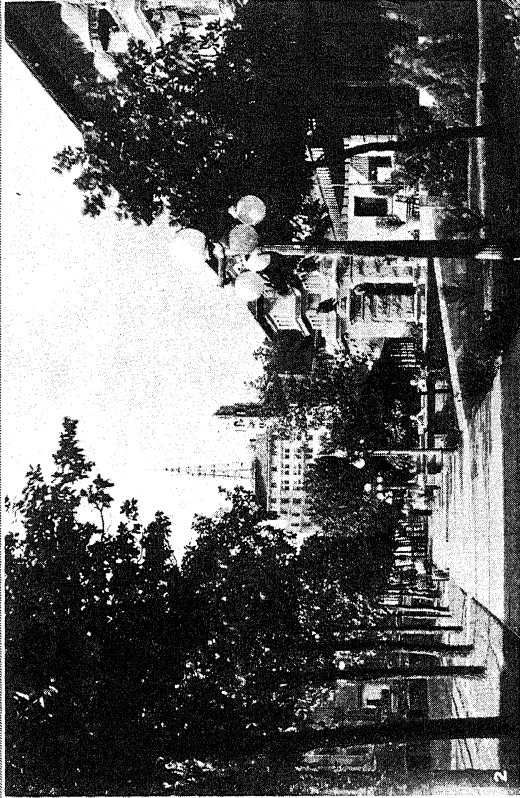
**ARKANSAS**, one of the south central states of the United States, popularly called the "Bear State." It is situated between 33° and 36° 30' N. lat. and 89° 40' and 94° 42' W. long. On the north it is bounded by Missouri, on the east by Tennessee and Mississippi

from which it is separated by the Mississippi River, on the south by Louisiana and on the west by Oklahoma and Texas. Arkansas comprises an area of 53,335 sq. mi., inclusive of 810 sq. mi. of water surface. In shape



ARKANSAS STATE SEAL

# ARKANSAS



1. PHOTO U. S. FOREST SERVICE; 2. COURTESY CHAMBER OF COMMERCE, HOT SPRINGS NATIONAL PARK; 3. CHAMBER OF COMMERCE, CAMDEN; 4. CHAMBER OF COMMERCE, LITTLE ROCK

## CHARACTERISTIC SCENES IN ARKANSAS

1. Former home of Cephas Washburn, founder of Arkansas' first school, in Ozark National Forest. 2. Central Avenue, Hot Springs, with the famous "Bath House Row."
3. Barge loaded with cotton on the Ouachita River near Camden. 4. Little Rock, the capital, from the air.



the state is approximately a square, measuring about 250 mi. on each side. In size Arkansas ranks twenty-sixth among the states of the Union.

**Surface Features.** The two topographical regions of Arkansas can be separated by a line drawn from the northeast corner of the state southwestward through Little Rock to Arkadelphia and thence due west to De Queen. The northwestern section is a highland province divided by the Arkansas River into the Ozark region on the north and the Ouachita Mountains on the south. The Ozark region has two divisions. Springfield plateau, 1,000 to 1,500 ft. high, extends from beyond the Missouri boundary into northern Arkansas. Gently rolling hills and canyon-like valleys diversify its surface. The Boston Mountains, covering a belt about 35 mi. wide and 200 mi. long from east to west, overlook the Springfield plateau from a steep north-facing escarpment. The mountain tops consist of a tableland 2,200 ft. high, cut into numerous ridges by narrow ravines 500 to 1,400 ft. deep. Their southern face has a moderate slope toward the Arkansas river valley.

The Ouachita Mountains cover a belt 50 to 60 mi. wide which extends into Oklahoma. They consist of a series of narrow parallel ridges having sharp, uneven crests, separated by wide basins. Their height increases from 750 ft. near Little Rock to 2,800 ft. at the western border.

Between the Ozark and Ouachita regions is the Arkansas valley. It is a fairly level plain 30 to 40 mi. wide and 300 to 600 ft. above sea level. Isolated peaks such as Sugarloaf, Poteau and Magazine mountains rise from its floor.

The southeastern part of the state is a rolling plain ranging in elevation from 100 to 700 ft. and sloping toward the southeast. Its most prominent feature is Crowleys Ridge, 12 mi. wide and 400 ft. high, in the northeastern corner. A strip along the eastern boundary, including the St. Francis River basin, belongs to the Mississippi River flood plain.

Arkansas has a mean elevation above sea level of 650 ft. Blue Mountain on the boundary between Polk and Scott counties, and Magazine Mountain in Logan county, both 2,800 ft., are the highest altitudes. The lowest point, 55 ft., occurs in Ashley Co., where the Ouachita River enters Louisiana. The St. Francis, White, Arkansas, Ouachita and Red rivers drain the state into the Mississippi.

**Climate.** Because of its situation in the lower Mississippi Valley, Arkansas exhibits a relatively mild climate. The mean annual temperature is 61.2° F. At Little Rock, the average for January is 41.4° F. and for July, 80.9° F. During the period, 1891-1930, the highest temperature recorded in Arkansas was 116° F. and the lowest, -29° F. The average annual precipitation for the state is 47.7 in. There are 241 days in the average growing season at Little Rock.

**Forests and Parks.** Approximately 32,000,000 acres of a total land area of 33,616,000 were originally forested chiefly with yellow pines, oak, cottonwood, red gum, cypress and ash. In 1928 the forested area

amounted to about 21,000,000 acres. There are two national forests in the state, Ouachita and Ozark, with a total net area of 1,171,895 acres. These national forests are open to the public for recreational use except during periods of extreme fire danger. Two game refuges of approximately 10,000 acres were leased by the state in 1927 and within the Ozark National Forest four areas have been set aside for game preservation purposes and are being restocked by the Federal government. Arkansas has three state parks: PETIT JEAN; Mt. Nebo, St. Park, 240 acres, one of the highest points in the state located in Yell Co.; and Arkansas Post State Park, established in 1931, which is the site of the first settlement in Arkansas. See ARKANSAS; *History*. Henri de Tonti, one of La Salle's lieutenants, built houses at Arkansas Post in 1686 with the help of ten Frenchmen and a few Indians. HOT SPRINGS NATIONAL PARK also is located in Arkansas.

**Minerals and Mining.** Petroleum, coal, natural gas, and bauxite, a valuable ore of aluminum, are the chief mineral resources. With mineral productions for 1929 amounting to \$41,324,576, Arkansas stood twenty-third among the states, ranking first in bauxite and eighth in petroleum. The principal products in order of value were petroleum, 24,917,000 bbls., \$21,890,000; coal, 1,695,108 tons, \$5,624,000; natural gas, 19,928,000 M cu. ft., \$3,802,000; natural gasoline, 33,455,000 gal., \$2,419,000; bauxite, 351,054 long tons, \$2,181,158; and clay products, \$2,024,403.

Various other minerals of less commercial importance are mined. Among these are limestone, sandstone, granite and quartzite for building material, novaculite for whetstones, marble, and phosphate rock. Mineral waters are extensively bottled. In Pike County diamonds in limited quantities have been found. During 1929 137 mines and quarries gave employment to 5,453 persons who received \$5,726,799 in salaries and wages.

**Soil.** South of Little Rock along the Arkansas River, black, silty soils abound, remarkably well adapted for the raising of seed cotton. These soils comprise the richest crop area of the state. North of Little Rock in the Arkansas Valley, a sandy loam prevails, but in the uplands of the northwest, the soil becomes very sandy and light. Perhaps the poorest agricultural land in the state is that composed of "gumbo," a heavy, moist clay which is abundant in the Red River Valley.

**Agriculture.** Cotton growing is the preeminent agricultural interest.

In 1930 16,052,962 ac. or 47.8% of the entire land area was in farms, 242,334 in number, with an average size per farm of 66.2 ac. and an average value per acre of \$34.13. Of the farm area 7,907,328 ac. was crop land; 3,792,416 ac., pasture land; and 3,378,967 ac., woodland. The total value of farm property was \$649,877,072, of which \$547,828,250 was represented by land and buildings; \$33,116,340 was represented by implements and machinery; and \$68,932,482, by domestic animals.

According to the census of 1930 Arkansas produced in 1929 field crops to the value of \$210,181,820, ranking fifteenth among the states. It stood second in rice, third in cotton and cottonseed, second in strawberries, sixth in peaches and eighth in grapes. The chief crop was cotton, 1,398,475 bales grown on 3,446,485 ac. and valued at \$116,772,663, together with cottonseed, 685,902 tons, \$19,891,158. Other important crops were grains, \$34,812,690, including corn 27,388,105 bu., rice 6,958,105 bu. and oats 653,887 bu.; vegetables, \$15,351,128; hay, 675,342 tons, \$10,166,404, and fruits and nuts, \$7,178,050. Among the vegetables were potatoes \$3,523,443, sweet potatoes \$2,142,726, tomatoes \$824,184 and watermelons \$411,189. The leading fruit and nut crops were peaches 1,838,214 bu., apples 1,272,663 bu., strawberries 26,632,460 qts., grapes 15,633,384 lbs. and pecans 248,084 lbs. The yield of sweet sorghum, grown on 11,748 ac., was 539,400 gals.

Farm products sold by cooperative marketing fell from \$4,726,491 in 1919 to \$3,153,892 in 1929. Farm machinery and equipment in 1930 included 65,935 automobiles, 11,000 motor trucks, 5,684 tractors, 1,460 electric motors and 4,730 stationary gas engines.

**Irrigation.** For the production of rice irrigation has been established in the eastern part of the state, mostly since 1910. According to the census of 1930 irrigation is limited almost entirely to 11 counties, four of which, Arkansas, Lonoke, Poinsett and Prairie, contained 84% of the farms irrigated, 89% of the acreage irrigated, and produced 88% of the rice crop of the state.

The total number of irrigated farms was 1,096, with an aggregate area of 363,549 ac., of which 151,787 ac. were irrigated. Including land and buildings the value of all irrigated farms was \$16,002,854, or an average of \$44.02 per ac. The total investment in irrigation enterprises to 1930 was \$6,836,648, and the average cost of maintenance and operation for 1929 was \$7.03 per ac.

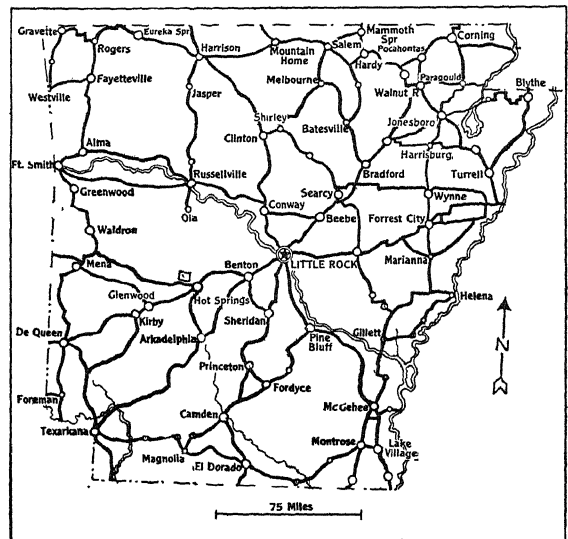
**Animal Industry.** Cattle-raising, chiefly for milk production, and mule-raising, in which Arkansas ranks third among the states, are the principal livestock interests. According to the census of 1930 the state ranked thirty-first in total value, \$68,932,482, of domestic animals on farms. Among these were cattle, 811,412, valued at \$26,833,532; mules, 361,508, \$24,825,757; horses, 137,747, \$6,023,466; swine, 776,208, \$5,938,690; sheep, 85,800, \$443,907; goats, 71,835, \$156,438, and asses and burros, 2,924, \$112,207.

Of the cows on farms, 389,077 were kept mainly for milk production and 49,056 mainly for beef production. In 1929, 128,568,652 gals. of milk were produced; the total value of dairy products sold was \$8,616,123. The value of all poultry raised, chiefly chickens, was \$8,264,452; the chickens sold were valued at \$2,826,852. Of 39,129,649 doz. chicken eggs produced, valued at \$10,516,313, 19,589,818 doz., with a value of \$5,174,994, were marketed. Honey, amounting to 919,633 lbs. valued at \$173,300, was produced from 82,149 hives.

**Fisheries.** The fish catch of 1930 which amounted to 17,544,000 lbs., valued at \$678,000, was taken from the Mississippi and tributary rivers. The most important commercial species are buffalo fish, catfish, carp, crappie, sheepshead and paddlefish. In 1930 the state fish hatchery at Lonoke employed two men and \$35,000 was spent on fish propagation. Over 500,000 large mouth black bass were distributed in the various waters of the state. In the same year, 26,400 licenses were issued for which \$62,000 was received. The United States Bureau of Fisheries distributed 16,190 rainbow trout, 1,565 crappies, 246,185 large mouth bass, and 15,400 rock bass in Arkansas lakes and streams.

**Transportation.** The MISSISSIPPI RIVER is the most important waterway, giving Arkansas communication with the Atlantic, Pacific and Gulf coasts. In addition, many smaller navigable rivers, accommodating boats of not over 3-ft. draft, afford a total of about 3,000 mi. of navigable waterways, the most extensive river system of any state in the Union. These have been largely improved by the Federal Government. However, with the exception of the Mississippi artery, it is not greatly used. The railroad facilities are good, practically throughout the state. The aggregate railway mileage in 1930 was 4,809. The Missouri Pacific, the Rock Island, the Kansas City Southern and the St. Louis & San Francisco railroads were the principal trunk lines. Little Rock is the most important railway center.

On Jan. 1, 1930, there were 76,464 mi. of highway, of which 7,958 mi. were surfaced roads and



ARKANSAS STATE ROADS

6,015 mi. state highways. The total highway expenditure during 1929 was \$31,942,511, of which the state paid \$25,487,511 and county and local governments \$6,455,000. The state gasoline tax produced a gross revenue of \$6,427,273 in 1930. Motor vehicle registrations during 1930 were 220,204, compared with

183,589 in 1925. Expansion in bus transportation during this period was rapid, with 1,441 buses operating in 1930, as against 303 in 1925.

**Manufactures.** Forest, agricultural and mineral resources form the foundation of the state's manufacturing industries.

According to the Census of 1930 Arkansas with manufactures for 1929 valued at \$210,903,228 stood thirty-ninth among the states. Its 1,731 establishments gave employment to 4,542 officers and employees, who received \$9,942,946 in salaries and to 44,205 wage earners, who were paid \$39,503,121 in wages. These factories used a total of 223,034 horse power, expended \$4,233,660 for fuel and power, and \$112,414,815 for materials and supplies, and added by the process of manufacture \$94,254,753 to the value of their output.

The leading industry is the manufacture of lumber, timber and planing mill products. These, valued at \$64,684,601, comprised 30% of the total manufactures of the state. Among other important manufactures were cottonseed oil, cake and meal valued at \$21,451,731, surpassed only by Texas, Mississippi and Georgia; petroleum refining, \$18,906,361; car construction and steam railway shop repairs, \$13,108,148, and rice cleaning and polishing, \$7,481,340. The chief industrial centers are Little Rock with an output of \$21,308,698 and North Little Rock \$11,713,549; Fort Smith, \$15,786,331, and Pine Bluff, \$8,325,367.

**Commerce.** According to the census of 1930, there were in 1929 2,052 wholesaling establishments in Arkansas, with total sales of \$373,074,089. These organizations gave full-time employment to 8,463 men and women, whose salaries for the year aggregated \$12,194,542. The chief wholesaling center is Little Rock.

Total sales of the 18,040 retail stores amounted to \$411,494,753. Sales per store averaged \$22,810; sales per capita were \$221.89.

#### CHIEF RETAIL DISTRIBUTING GROUPS

Group	No. of Stores	Sales	% of Total
General Mdse. . . .	4,601	\$143,144,928	34.78
Automotive . . . .	3,056	86,787,250	21.10
Food . . . .	4,900	69,221,911	16.83
Lumber & Bldg. . . .	522	21,669,002	5.27
All other stores . . .	4,961	90,671,662	22.02
Total, all stores . . .	18,040	\$411,494,753	100.00

**Finance and Banking.** The assessed value of all real and personal property in Arkansas in 1929 was \$1,248,649,700. In 1930 the total bonded debt was \$88,022,167. Total revenue receipts in 1928 were \$20,001,152; total expenditures \$30,848,112. The chief revenues were from property and special taxes, 30.8%, and licenses, including gasoline sales tax and motor vehicle tax, 47.1%. The principal expenditures were for highways, \$12,851,143; permanent improvements, \$10,887,747; and educational aid, \$3,670,505.

There were 308 banks in Arkansas in 1930, of which 53 were national banks, 253 trust companies and state banks and 2 private banks. Their aggregate capitali-

zation was \$16,099,525; surplus and undivided profits were \$12,312,000. Total resources were \$253,376,000; loans and discounts \$157,218,000. Demand and time deposits including postal savings aggregated \$182,690,000. Per capita demand and time deposits were \$97.85; per capita savings deposits \$38.64. The total savings of \$72,150,000 were owned by 120,822 depositors. National bank circulation aggregated \$3,772,000.

**Government.** Legislative authority is vested in a senate composed of 35 members and a house of representatives of 100 members, the former elected for terms of four years and the latter for terms of two years. They meet in biennial sessions which are limited in duration to 60 days. A governor, secretary of state, treasurer, auditor and attorney-general compose the executive department, each elected for two-year terms. The governor receives a salary of \$4,000 per annum. He has the right of pardon and of veto, but his veto may be overridden by a majority vote of each house. The highest judicial power is vested in the supreme court composed of five judges elected for terms of eight years at salaries of \$4,000 per annum. Circuit courts, probate and county courts, and justices of the peace complete the judiciary department.

**Social Welfare Institutions.** At Little Rock is a state training school for girls. Near Little Rock is a Confederate Soldiers' home and a hospital for nervous diseases and insane. There is a penal farm for whites at Tucker and for Negroes at Cummings. At Pine Bluff are industrial schools for white and colored boys, and at Jacksonville a state farm for women. A tuberculosis sanatorium is located at Booneville. The penitentiary is at Little Rock.

**Education.** The first schools in the territory were Jesuit mission schools for Indians and private schools for white children. These were founded prior to the passage of the public school law in 1829, which resulted in the establishment of Batesville Academy. The state provides separate schools for white and colored children. In 1929 there were 6,316 public elementary schools, with 440,469 pupils and 10,992 teachers. The 400 high schools had 38,639 pupils and 1,868 teachers. A law enacted in 1909 requires all children from 8 to 16 years of age to attend school one-half of the school term.

The number of persons from 5 to 20 years of age attending school in 1930 was 449,117, or 66.3% of the population within the ages specified, as compared with 406,727, or 61.2% in 1920. The number of persons 10 years and over unable to read and write in 1930 was 96,818, or 6.8%; as compared with 121,837, or 9.4%, in 1920. In 1930 Negro illiterates numbered 60,102, or 16.1% of the Negro population 10 years and over; in 1920, 79,245, or 21.8%. Native white illiterates numbered 35,890, or 3.5%, in 1930; and 41,411, or 4.5%, in 1920.

The state institutions of higher learning include the University of Arkansas at Fayetteville, the State Teachers College at Conway, and agricultural and



mechanical colleges at Jonesboro, Magnolia and Monticello. Among the private educational institutions are Ouachita College at Arkadelphia, Central College at Conway, and Galloway Woman's College at Searcy, and for Negroes, the Philander Smith College and Arkansas Baptist College, both at Little Rock. The Arkansas Free Library Service Bureau, under the State Department of Education, is located at Little Rock.

**Population.** In 1930 Arkansas ranked twenty-fifth among the states with a population of 1,854,482 or an average of 35.3 per square mile, an increase of 102,278 or 5.8% over 1920. The population rose from 1,062 in 1810 to 435,450 in 1860, 1,311,564 in 1900, 1,574,449 in 1910, and to 1,752,204 in 1920. In 1930 there were 1,374,906 or 74.1% whites, 478,463 or 25.8% Negroes, and 408 Indians, an increase from 1920 of 7.4% whites and 1.3% Negroes. Of the whites, 1,364,733 were native born and 10,173 were foreign born. The rural population was 1,471,604 or 79.4% of the total, an increase of 9,897 or 0.7% from 1920; the urban population was 382,878 or 20.6% of the total, an increase of 92,381 or 31.8% since 1920. In 1930 the four largest cities were Little Rock, 81,679; Fort Smith, 31,429; Pine Bluff, 20,760; Hot Springs, 20,238.

**Occupations.** In 1930 667,845 persons, or 36% of the population, were gainful workers 10 years old or older; 82.2% of these were males and 17.8% were females; 68.8% were native white; 0.9% foreign-born white, and 30.2% Negro. In agriculture, the principal occupation, 384,381 persons were engaged; of these 238,763 were farmers and 59,624 farm wage workers. Among other important occupations, with number of workers, were manufacturing, 81,960; trade, 51,151, including 17,751 retail dealers and 15,402 sales persons; domestic and personal service, 49,481; transportation and communication, 36,445; professional service, 27,909, of whom 12,457 were school teachers, 3,157 men and 9,300 women, and clerical service, 17,322.

### HISTORY

Formerly called the "Bear State," but by legislative enactment in 1923 named the "Wonder State," Arkansas was originally a part of the Louisiana Territory. The first white men within its boundaries were FERNANDO DE SOTO and his company, who spent the Winter of 1541-2 exploring its eastern part. The next Europeans to enter it were the Frenchmen, MARQUETTE and JOLIET, who, journeying down the Mississippi in 1673, camped at the mouth of the Arkansas River. Nine years later LA SALLE gave to his lieutenant, HENRI DE TONTI, a large grant of land upon which was established in 1686 the first settlement at Arkansas Post on the Mississippi River a few miles above the Arkansas. The tribe of Indians living there gave the name to the settlement, the river and, later, the state. In 1718 an extensive grant was made to John Law, a colony was established, and Negro slaves were brought in; but the colony was abandoned after Law's failure. In 1762 the region passed to Spain,

but was ceded to France in 1800. The United States acquired Arkansas in 1803 as part of the LOUISIANA PURCHASE; during the last decade of Spanish possession there was considerable American immigration. In 1812 it was separated from Louisiana as part of Missouri Territory; in 1819 Arkansas Territory, including the present Oklahoma, was organized, with Arkansas Post, which had been the residence of the French and Spanish governors, as the first capital. The next year the capital was removed to Little Rock, founded and named in 1722 by Bernard de la Harpe as a trading post.

Arkansas, with a population of about 124,000, was admitted to the Union as a slave state June 15, 1836. Although the state had been sharply divided on the question of secession, Arkansas seceded on May 6, 1861. Several battles were fought within its borders, and by 1863 the Union forces recovered a large part of the state. A loyal anti-slavery government was established in 1864, but the state was not readmitted until June 23, 1868. Under "carpet bag" rule anarchy prevailed for some time, finally developing into armed conflict between the supporters of the Republican and Democratic candidates for governor. In 1874 a new constitution was adopted. It has since been liberalized and modernized by the adoption of amendments, the most important of which provided in 1910 for the initiative and referendum.

Beginning about 1880 much land was reclaimed by levee construction and drainage, but in 1929 the Mississippi broke over the levees and disastrous floods caused wide suffering during 1929 and 1930.

Consistently Democratic in politics, Arkansas returned Hattie W. Caraway to the Senate in the 1932 election, and elected J. Marion Futrell governor.

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**ARKANSAS, UNIVERSITY OF**, at Fayetteville, Ark., a state university for men and women, founded in 1871 as Arkansas Industrial University. The university comprises colleges of Liberal Arts and Sciences, Agriculture, Engineering and Education; schools of Law, Business Administration and Medicine; and General Extension Service. The School of Medicine is located at Little Rock. The library contains 82,000 volumes. In 1930 there was a student enrollment of 1,700, and a faculty of 160 headed by Pres. JOHN CLINTON FUTRELL.

**ARKANSAS CITY**, a city in Cowley Co., southern Kansas, situated on the Arkansas River, 56 mi. southeast of Wichita. It is a railroad center served by four lines. There is a commercial airport 2 mi. distant, and motor bus service. The region produces wheat, corn and live stock. The local industries include oil refining and the manufacture of oil field equipment, candy, flour and foundry products. The retail trade in 1929 amounted to \$8,024,208. Gas and oil are the natural resources of this region. A government school for the Chilocco Indians, founded in 1884, is a few miles away in Oklahoma. The Gueda



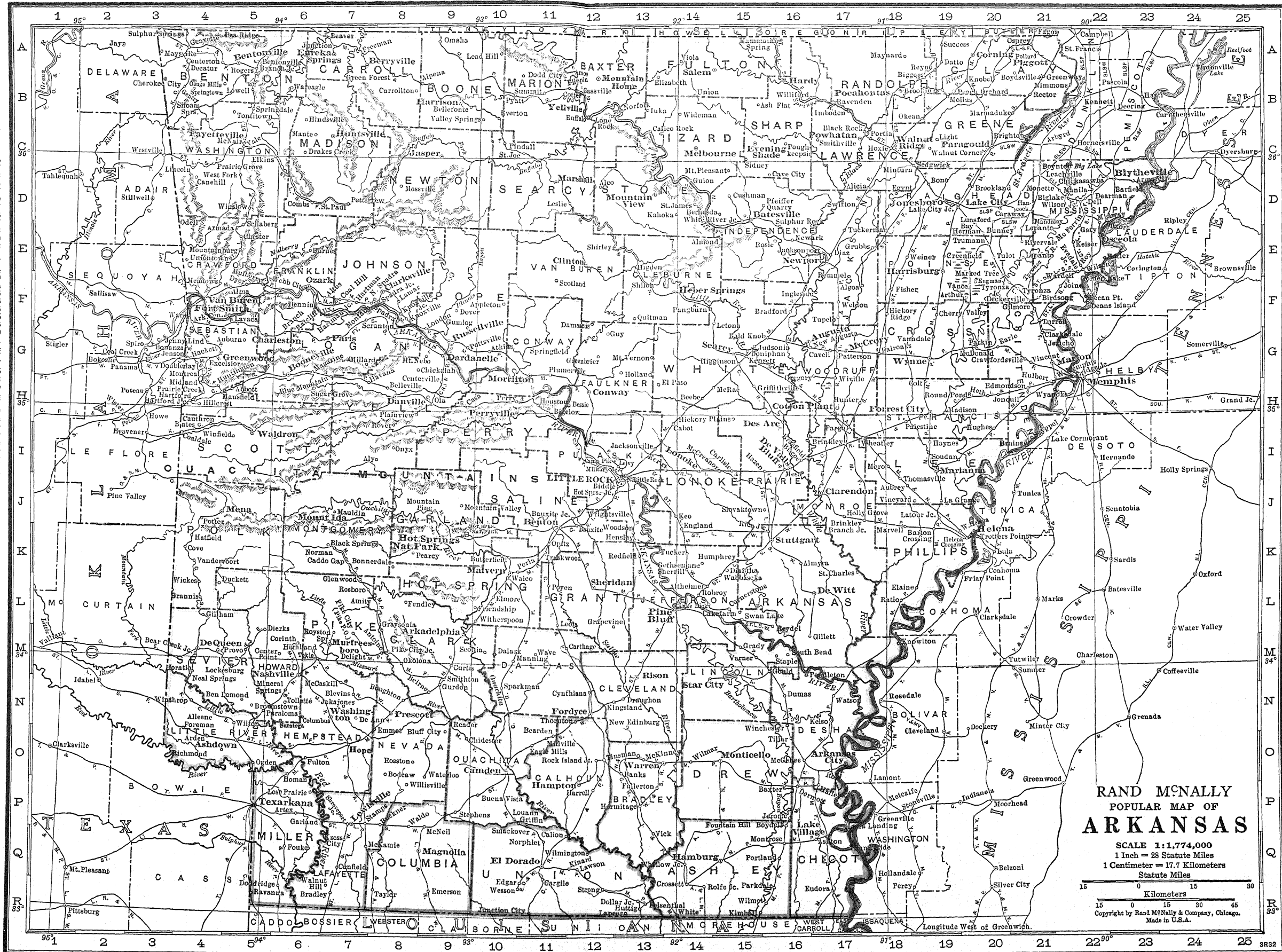
# ARKANSAS

Area 53,335 sq. m.  
Pop. 1,854,482

## PRINCIPAL CITIES

Pop.—Thousands

- 3 Arkadelphia M 9
- 2 Ashdown O 4
- 1 Atkins G 10
- 2 Augusta G 16
- 1 Bald Knob G 15
- 4 Batesville D 15
- 1 Bearden O 11
- 1 Beebe H 14
- 2 Benton J 11
- 1 Berryville A 7
- 10 Blytheville D 22
- 2 Booneville H 6
- 3 Brinkley I 17
- 7 Camden O 10
- 2 Clarendon J 17
- 3 Clarksville F 8
- 1 Coal Hill F 7
- 6 Conway H 12
- 2 Corning A 20
- 1 Cotter B 12
- 2 Cotton Plant H 17
- 3 Crossett R 14
- 2 Dardanelle G 9
- 3 De Queen M 4
- 2 Dermott P 16
- 1 Des Arc H 16
- 2 De Witt L 16
- 2 Dierks M 5
- 2 Dumas N 16
- 2 Earle G 20
- 16 El Dorado Q 11
- 2 England K 14
- 2 Eudora R 17
- 2 Fayetteville A 7
- 7 Fordyce N 12
- 5 Forrest City H 19
- 31 Fort Smith F 4
- 1 Glenwood L 7
- 2 Gurdon N 9
- 2 Hamburg Q 14
- 1 Harrisburg E 19
- 4 Harrison B 9
- 1 Hartford H 4
- 1 Heber Springs F 14
- 8 Helena K 20
- 6 Hope O 7
- 1 Horatio M 4
- 20 Hot Springs F 20
- 1 Hoxie C 18
- 1 Huttig R 13
- 10 Jonesboro D 19
- 1 Judsonia G 15
- 2 Lake Village Q 17
- 1 Leachville D 21
- 1 Lepanto E 21
- 1 Levy I 13
- 1 Lewisville P 7
- 82 Little Rock J 13
- 2 Lonoke I 14
- 3 McGhee O 16
- 3 Magnolia Q 8
- 5 Malvern K 10
- 1 Manila D 21
- 4 Marianna I 19
- 1 Marion G 21
- 2 Marked Tree F 20
- 3 Mena J 4
- 2 Millville O 11
- 1 Monette D 21
- 3 Monticello I 15
- 4 Morrilton H 11
- 2 Nashville M 6
- 5 Newport E 17
- 19 North Little Rock I 13
- 3 Osceola E 22
- 2 Ozark F 6
- 6 Paragould C 20
- 3 Paris G 7
- 2 Parkin G 20
- 2 Piggott A 21
- 21 Pine Bluff L 14
- 2 Pocahontas B 18
- 3 Prescott N 3
- 2 Rector B 21
- 4 Rogers A 5
- 6 Russellville G 9
- 2 Searcy G 15
- 2 Siloam Springs B 3
- 3 Smackover P 11
- 3 Springdale B 5
- 3 Stamps P 7
- 5 Stuttgart K 16
- 11 Texarkana P 5
- 3 Truman E 20
- 5 Van Buren F 4
- 1 Waldron I 5
- 2 Walnut Ridge C 18
- 3 Warren O 13
- 1 W. Helena K 19
- 1 Wilson E 22
- 4 Wynne G 19



RAND McNALLY  
POPULAR MAP OF  
ARKANSAS

SCALE 1:1,774,000  
1 Inch = 28 Statute Miles  
1 Centimeter = 17.7 Kilometers  
Statute Miles

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Medicinal Springs are in the vicinity. Arkansas City was founded under the name of Creswell in 1870 and incorporated in 1872 under its present name. Pop. 1920, 11,253; 1930, 13,946.

**ARKANSAS RIVER**, a large western tributary of the Mississippi, traversing parts of Colorado, Kansas, Oklahoma and Arkansas. It rises in the Rocky Mountains of central Colorado at an altitude of 10,000 ft. The first part of its course runs southeastward through mountains with an average fall of 40 ft. per mi. Royal Gorge, the course of this river in Fremont Co., Colorado, ranks as one of the deepest of United States canyons. Upon entering the plains its slope diminishes and in its eastward course from Pueblo to the Kansas boundary line, a distance of 500 mi., the descent averages 7 ft. per mi. In spite of this steep slope the river, being heavily loaded with detritus, deposits rather than erodes and is in effect a graded stream. After crossing the treeless plains of western Kansas it changes its course to southeast, traverses the northeastern corner of Oklahoma and bisects Arkansas before entering the Mississippi in Desha Co., 37 mi. above Arkansas City. It is 1,460 mi. long and navigable for 465 mi. to the mouth of the Neosho. Other important tributaries are the Little Arkansas, Cimarron and Canadian rivers. The area drained by the Arkansas is an important agricultural region extending over 161,000 sq. mi. The upper course of the river supplies water for irrigation.

**ARKOSE**, a variety of SANDSTONE composed of well compacted sands containing considerable FELDSPAR. Such sands are the product of the WEATHERING of feldspathic rocks, like the granites, when the residual materials have not been transported great distances, as otherwise the soluble feldspars would dissolve. *See also* SAND; GRANITE.

**ARKWRIGHT, SIR RICHARD** (1732-92), British inventor, was born at Preston, England, Dec. 23, 1732. He had little schooling and when a young boy was apprenticed to a barber. While engaged in this trade he invented a way of dyeing hair and about 1760 became a hair merchant near Manchester. Through watching the processes of cotton manufacture in this district, he devised a spinning frame on which a great number of threads could be spun at one time instead of a single thread on a wheel. This invention revolutionized the textile industry. In 1769 with the financial help of partners he built a mill at Nottingham, and later erected others in which his invention, now patented, was used. His systems of management and his continual improvements in cotton-working machines built up a business worth \$2,500,000, although his patents were nullified by the courts in 1785. He died at Willersley, Aug. 3, 1792.

**ARLES**, an ancient town, situated on the left bank of the Rhône, department of Bouches-du-Rhône, southeastern France, about 55 mi. northwest of Marseille. Archeologically, it is one of the richest and most interesting towns in France. Once a prosperous Roman colony, known as Arclate, and residence of the Emperor Constantine, Arles still pos-

sesses its imposing Roman arena and some noble remains of the antique theater where the Venus of Arles, now in the Louvre, was discovered in 1651; there are also a Roman cemetery and other classic monuments. In the 10th century it became the capital of the Kingdom of Arles, and in the 12th century Arles was made a free city. Among the notable buildings is the Romanesque church of St. Trophime, with an especially beautiful façade and a fine cloister. In modern times Arles has been a center in the Provençal literary revival of the Félibrige; it has an interesting regional museum as well as a rich museum of classic remains. Pop. 1931, 32,485.

**ARLINGTON**, a township of Middlesex Co., Massachusetts, adjoining Somerville and Cambridge, about 6 mi. northwest of Boston. It is served by the Lexington branch of the Boston and Maine Railroad and by the Boston elevated railway. Market gardening is very profitable locally, and manufactures include piano cases, boiler finishings, picture-frames and other commodities. In 1929 the manufactures reached about \$3,000,000; the retail trade amounted to \$9,818,701. Originally part of Cambridge, the town separated as West Cambridge, 1807, and adopted the present name sixty years later. The vicinity figured prominently in the Revolutionary War, sites and memorials of which are preserved. John T. Trowbridge, writer, and Cyrus Dallin, sculptor, lived there. Arlington Heights is a health resort. Pop. 1920, 18,665; 1930, 36,094; 5% foreign-born.

**ARLINGTON HOUSE**, a historically famous mansion in Virginia, situated on the wooded heights across the Potomac River from Washington, D. C., on an estate that once belonged to George Washington. This impressive Colonial home was built in 1802 by Parke Custis, the adopted son of Washington. It became the residence of the Confederate general ROBERT E. LEE in 1831, the year of Lee's marriage with Mary Ann, the daughter of Custis. Built of stuccoed brick, and said to have been modeled after the Athenian Temple of Theseus, the house, with its stately portico of eight columns in Greek Doric proportions (though with Roman capitals and entablature), is one of the noblest examples of the Colonial style. The mansion and beautiful grounds, deserted by Lee and his family in 1861, were seized by the Union Army, and were used as a military headquarters, camp and hospital, later being converted into a national cemetery (*see* ARLINGTON NATIONAL CEMETERY).

**ARLINGTON MEMORIAL BRIDGE**, a reinforced concrete structure over the Potomac River, linking Washington, D.C., and Arlington (Va.) National Cemetery. Construction was begun in 1926, and substantially completed in 1930. The bridge consists of 9 spans, ranging from 166 to 180 ft., with a bascule draw-span in the center to permit passage of river navigation. The structure is 2,138 ft. in length, with a roadway 60 ft. wide and sidewalks 15 ft. wide on either side. The concrete is faced with granite, and the arches handsomely decorated, making the bridge

an ornamental rather than an engineering project. On the Washington side the proposed approach will consist of a plaza built just west of the Lincoln Memorial, and the plans also provide for imposing entrance pylons on both shores. The cost of the bridge, exclusive of the approach developments, was \$7,250,000. The Arlington Memorial Bridge Commission has proposed the erection of statues of celebrated Americans on the balustrades of the structure.

**ARLINGTON NATIONAL CEMETERY**, the great national burial ground of America's military heroes, situated at Arlington, Va., on the banks of the Potomac River, opposite Washington, D. C. The site of Arlington, occupying 408 acres, commands a splendid view of the river, and is justly famous for its natural beauties. The last resting place of American soldiers, its use as a cemetery dates from the Spring of 1864 and is directly associated with the conversion of Arlington House, the former mansion of Robert E. Lee, into a Union Hospital during the Civil War. The title to Arlington became properly the government's in 1883, when \$150,000 was paid to G. W. Custis Lee for his claims to the estate.

In the Fields of the Dead, row upon row of plain headstones—more than 25,000 in number—mark the graves of soldiers slain in American wars. Of those buried at Arlington, more than 21,000 were soldiers of the Civil War, and it is thought that the first to be buried here was a Confederate prisoner named Reinhardt, of North Carolina, who died in the Federal hospital. A granite sarcophagus, erected in 1866, marks the burial place of 2,111 unidentified heroes whose bones were gathered from the field of Bull Run and the route to Rappahannock.

In the southern part of the cemetery lie the 163 unidentified victims of the explosion of the *Maine* on a spot marked by the tower, the mast and the anchor of the historic battleship. Many of those killed in the Spanish-American War repose close by.

The Tomb of the Unknown Soldier, the scene of a solemn service each Memorial Day, consists of a sarcophagus, 11 ft. high and 9 ft. wide, constructed of Colorado marble. *See also* UNKNOWN SOLDIER.

The impressive amphitheater, erected through the efforts of the Grand Army of the Republic as a memorial to departed heroes, was dedicated on May 20, 1920. Covering an area of 3,400 sq. ft., with marble benches which accommodate about 5,000 people, it is a roofless structure made of fine white marble, and was modeled after two classic amphitheaters, that of Dionysus at Athens, and the Roman theater at Orange, France. Beneath its sweeping colonnade are crypts where may be buried distinguished officers, soldiers or marines.

**ARLISS, GEORGE** (1868- ), English actor, was born at London, Apr. 10, 1868. He was educated in London where he made his first stage appearance in 1887. After touring in the English provinces he joined Mrs. Patrick Campbell's company with which he toured the United States in 1901. The next year he signed a contract with David Belasco to appear in

New York. He played with Mrs. Fiske in *Becky Sharp* and other plays. His most successful rôles were in *The Devil*, *Disraeli*, *The Green Goddess* and *Old English*. The latter three have been produced in talking pictures with Arliss also in the leading rôles.

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**ARM**, the name generally used for the upper extremity of the human body, is technically that portion of the upper extremity between the shoulder and elbow, while the part between elbow and wrist is the forearm.

There is one bone in the arm proper, known as the humerus. The arm possesses considerable range of motion, dependent on a variety of types of articulation between the bones. The shoulder joint is a ball and socket joint allowing free movement until the arm is at right angles to the body axis. When raised above this point, the shoulder blade or scapula rotates laterally. The elbow joint is a hinge joint, allowing no side-play. There are two bones in the forearm, radius and ulna, which are articulated in such a manner that the hand may be placed with the palm facing downward or upward. These positions are called pronation and supination, respectively.

The axis of the forearm diverges a few degrees laterally from that of the arm. This is known as the carrying function, as it enables objects to be carried at a slight distance from the body without additional muscular effort.

For further facts on the anatomy of the upper extremity, *see* ARTERY; SKELETON; MUSCULAR SYSTEM.

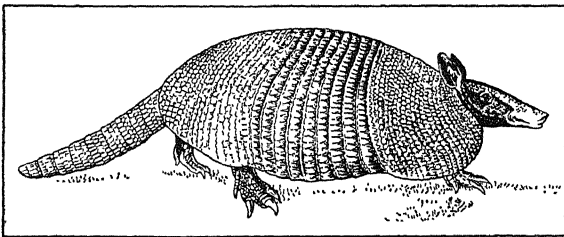
**ARMADA, THE**, sometimes called the "Invincible Armada," was the great fleet sent in May 1588 by Philip II of Spain to conquer England. The fleet consisted of 132 sail, of which nearly one-half were supply ships and transports. It carried 21,621 soldiers and 8,065 seamen and was under the command of the Duke of Medina Sidonia who had never commanded even a ship. His orders were to effect a junction with the Duke of Parma commanding the Spanish Army in the Netherlands and with his aid invade England. The great fleet appeared in English waters in the third week of July, the first action taking place off Plymouth on the 20th. The Spanish plan of battle was to bring their ships alongside the English and board the latter with soldiers. This maneuver was possible only so long as the Spanish ships kept to windward of the English, but so long as it was possible it constituted the greatest menace to the more weakly manned English. At the first contact between the fleets the Spanish held this advantage of the wind, and only by luck and the most expert seamanship did the English under Lord Howard of Effingham, supported by Drake, Hawkins and Frobisher manage to take clear and gain the wind themselves.

Then began a running fight between the smaller but swifter and better managed fleet of 197 English ships and the more cumbersome Spanish. The southwest wind, which had threatened to hem in the Eng-



lish off Plymouth, still held, and the Spanish worked up the Channel with the English hovering on their weather flank. The latter were too weak to close and risk a decisive engagement, and having lost the windward position (weather gage) the Spanish could not force such an action, however advantageous it would have been to them. At length having lost straggling ships and suffered from long range cannonading, at which they were inferior, the Spanish made Calais Roads on July 26, only to be demoralized and dislodged during the night by fire ships. Driven by the wind and the English, the Armada was forced eastward towards the shoals off the Flemish coast. Here (off Gravelines, July 29) was fought the most bitter encounter between the fleets. It was not decisive, for the English, crippled by short supplies, particularly powder, were unable to press their advantage. A night of storm followed, and the next morning the Spanish found themselves being blown against the bars of Nieuport; but just at the critical moment the wind changed and allowed them to escape into the North Sea. Pursued by the English and despairing of holding their own in the narrow seas, the Spanish attempted to return by rounding Scotland and Ireland. Heavy storms scattered the fleet. Half the vessels were wrecked or foundered while the crews of those that returned were decimated by fever, scurvy and starvation. From the defeat of the Armada dates the decay of Spanish sea power.

**ARMADILLOS**, peculiar horny-shelled mammals of South America, of which one species has strayed as far north as Texas. With the exception of the giant armadillo (*Priodon gigas*) of the forests of Surinam and Brazil, which measures 3 ft. without the tail, they are timid, inoffensive animals, no longer though bulkier, than a cat. The muzzle is pointed, the legs are short and armed with claws adapted to digging. Though ranking as edentates, armadillos have numer-



NINE-BANDED ARMADILLO

ous weak teeth, their food consisting of insects, snails, worms, small reptiles, and even carrion.

The armadillo is unique among mammals in possessing a body armor encasing all but the hairy under parts. This consists of peculiarly joined polygonal plates of bone, forming a cuirass over shoulders and haunches, or on the tail, of overlapping rings. Between the rigid fore-and-aft bucklers, the body is rendered flexible by a number, varying with the different genera, of movable transverse bands. When attacked, some armadillos roll up into a tight ball. Others, less perfectly armored, dig themselves under ground with

startling rapidity. The diminutive three-banded apar, of Argentina, which when rolled up presents to molesters a mailed ball impervious to tooth or claw, does not burrow, but scurries about in daylight, running on the tips of its long claws.

The larger Texas armadillo (*Dasypus novemcinctus*) whose armor is not proof against attacks by wolves, coyotes, and bobcats, is active mostly at night. This armadillo, which is mottled brown and yellowish white, ranges from the Rio Grande to Paraguay. Its flesh is esteemed a delicacy.

**ARMAGEDDON**, a form of Megiddo, used apocalyptically in Revelation 16:16. It therefore has become the symbolic name for a battlefield where the opposing forces, whether of good and evil or of material armies, decide the destinies of mankind.

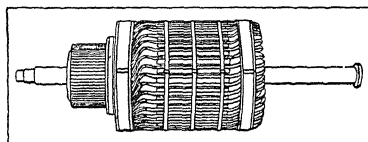
**ARMAGH**, a district and county town of County Armagh, Northern Ireland, situated near the Callon on the slope of a hill, about 89 mi. northwest of Dublin. Traditionally founded in the 5th century by St. Patrick, and the scene of a synod as early as 448, it is rich in educational and ecclesiastical association. Reduced to poverty by successive Danish and English attacks, the ancient cathedral, built about 444, in which Brian Boru was buried, suffered particularly, and finally in 1566 was laid in ruins by Shane O'Neill. In the past two centuries something of the ancient prosperity has returned, and Armagh again thrives, the see of both a Protestant and Roman Catholic bishop, having two handsome cathedrals on twin summits. There are also finely-built public works, hospitals, schools and a famous astronomical college. Pop. 1926, 7,400.

**ARMAMENT** may include all forces equipped for war, including land, naval and air forces. More strictly, armament is the munitions for war, comprising GUNS, AMMUNITION, TORPEDOES and the like. In the sense of munitions, armament is particularly concerned with coast defense guns set in permanent foundations and to the guns mounted on warships. See also ARTILLERY; ORDNANCE; WARSHIPS.

**ARMAMENTS, LIMITATION OF.** The rapid growth of competitive armaments during the latter part of the 19th century proved so costly and disquieting that the question of limitation by international agreement was sought, though unsuccessfully, at the First HAGUE CONFERENCE in 1899. Since the World War the Washington Conference of 1921 and the London Conference of 1930 have resulted in agreements among the principal naval powers to limit naval armaments. A world conference to consider the problem of limitation of land and air armaments as well, was held in February, 1932.

**ARMATURE**, a part of a DYNAMO ELECTRIC MACHINE in which (in the case of a generator) electric energy is developed by INDUCTION. In the case of a motor, the armature is the part in which electric energy to be transformed into mechanical energy is received from the source. For direct current generators and motors, the armature is practically always on the "rotor," or rotating element, the electric circuit com-

prising an armature winding and a COMMUTATOR. But for alternating current generators and synchronous motors, the electric circuits with the armature function are usually located on the "stator," or stationary element. A direct-current armature comprises a laminated iron core with a multiplicity of slots at its periphery. In these slots are located insulated conductors so interconnected to one another and to the segments of the commutator, on which rest stationary brushes, as to constitute a path for the current to flow,



DIRECT CURRENT ARMATURE, SHOWING  
COMMUTATOR AT LEFT

in the case of a generator; to the external system, or, in the case of a motor, from the source of electric energy into the machine. A direct current armature is shown in the illustration.

In many of the early types of alternating-current generators and motors, the *rotor* was usually employed for the armature function, the *stator* being employed for the field. This accounts for incorrect use, of the term "armature" as synonymous with "rotor," even when the field winding is on the rotor. *See also* ELECTRIC GENERATOR; MOTOR, ELECTRIC. H. M. H.

**ARMAVIR**, a city in the heart of the North Caucasian region of the R.S.F.S.R. at the southeastern end of European Russia, in the district bearing the same name. Founded about 1850 in the midst of productive dairy and grain country, it has developed rapidly. It is situated at the junction of the Kuban and Urup rivers, and so forms a commercial focus for the southern portion of the Kuban-Black Sea territory. Through it passes the railroad which connects the Black and Caspian seas. The inhabitants are mainly Russians, the remainder being a mixture of Armenians, Germans, Georgians, Poles, Jews and Tatars. Pop. 1926, 74,533.

**ARMED GUARD**, in time of war, a unit detailed to a designated Army transport by the Navy Department to perform specified duties in the control of the ship, its navigation and its defense. An armed guard comprises an officer not below the rank of lieutenant commander in the Navy and two other experienced officers together with a suitable number of quartermasters, signal men, extra lookouts, radio operators and a full gun's crew for each gun.

**ARMENIA**, one of three Soviet Socialist Republics forming the Transcaucasian S.F.S.R., situated on both slopes of the eastern portion of the Little Caucasus, and intersected by this range from northwest to southeast. Its area is 11,945 sq. mi. Georgia borders it on the north, Turkey on the west and southwest, the Nakhichevan Autonomous Republic on the southwest, and Azerbaidjan on the east. **ERIVAN**, with a population of 66,500, is the capital and principal city. Much

of Armenia consists of plateau land. The principal rivers are the Aras and Kura. The climate is very dry. Armenians compose 84% of the population, important minorities being Azerbaidjans, Turko-Tatars and Russians.

Agriculture predominates. Of 1,360,000 acres under cultivation in 1931, 61,000 were devoted to cotton. The natives have used artificial irrigation since Biblical times; there are now nearly 2,000 mi. of irrigation works; of these the Shirak Lenin Canal, completed in 1925, is 13 mi. long. Besides cotton, the soil yields mulberry trees for silk and fruits, rice and tobacco. Extensive pasture lands support large numbers of cattle. Among metals, copper is being mined in increasing quantities. The foremost industrial enterprises are cotton mills, textile factories and distilleries. Recent developments have included the establishment of 10 hydroelectric stations and the construction of railways.

Life has been poor and the lack of education general, but in 1932 conditions had changed considerably, as represented by the 800 primary schools, the numerous trade and technical schools, and the several institutions of higher learning. Armenia was organized as a Soviet republic in 1920. Pop. 1930, 1,009,300.

**History.** The name Armenia as a geographical term was applied to the upper valleys of the Euphrates and Araxes rivers by the Medes, who incorporated the region into their empire. This region remained a satrapy in the Persian empire of Darius, but by the time of Alexander the Great it had secured a semi-independent position, and so remained under Alexander and his eastern successors, the Seleucids. With the spread of Roman power in the east, Armenia allied herself with Mithradates in the last desperate struggle for independence in the east, and going down to defeat, was organized as a Roman protectorate by Pompey. Thereafter Armenia lay squarely upon the fluctuating frontier between Rome and the Sassanids, and later between Byzantium and the Caliphate, first held by one side and then ravaged by the other.

There is not and never was an Armenian race in the biological sense, and previous to Roman times Armenia was only a geographical term describing a region inhabited by peoples of various origins. Christianity was introduced in the 3rd century without altering this situation, but when the powerful Monophysitic tendencies among the Christians in Armenia drew them away from the western Christians and finally forced them to break off to form an independent Church after the Council of Chalcedon, 451, an Armenian people came into existence. Thereafter the name Armenian does not mean a resident of old Armenia, but a communicant of the Armenian Church, and even the geographical use itself shifts across the map with the movements of the Armenians and the rise or decay of the Armenian Church.

Armenia remained for centuries a buffer state between Byzantium and Persia, but during the 11th

century it was conquered by the Seljuk Turks. Many Armenian nobles left the region around Lake Van and erected an Armenia along the shores of the Mediterranean in Cilicia. This kingdom lasted until 1375, and with its dissolution ended the last independent Armenia.

The troubles in Armenia in the 19th and 20th centuries (*see* ARMENIAN MASSACRES AND QUESTION) suggested to the western powers the possibility of re-creating an Armenian state, but the same political intrigues and national jealousies which had stirred up warfare between the Turks and Armenians, equally prevented the formation of an independent or mandated Armenia. The modern Armenian Republic within the Soviet Union was erected of anciently Armenian territory taken from Turkey by Russia in 1828 and 1878.

**ARMENIAN CHURCH**, sometimes called the Gregorian Church, is believed by the Armenians to have originated through the preaching of St. Bartholomew and St. Thaddaeus or Jude in the first century of the Christian Era. More particularly it owes its existence to the revival of the faith of Christianity in Armenia under St. Gregory the Illuminator about 285, when the King as well as his nation accepted Christ, giving the Armenians the basis for their claim to be the first Christian nation. St. Gregory the Illuminator became the first bishop, and since his day a regular uninterrupted succession of patriarchs, who bear the title of Catholicos, have ruled the Church. The residence of the Catholicos and the headquarters of the Church are at Etchmiadzine, a famous monastery at the foot of Mount Ararat, near the Cathedral of the Only Begotten, one of the oldest Christian edifices, the founding of which is attributed by tradition to St. Gregory the Illuminator himself. Until the middle of the 5th century, when the fourth General Council of the Christian Church was held at Chalcedon, 451, the Armenian Church was in full fellowship with all branches of the Universal Church. Due to certain misunderstandings and the effort of the Persian King to force Mazdaism upon the people, the Armenians were not represented at the Council of Chalcedon, and at a General Synod held in 491, the decrees of that council were denounced by them. Although in general the Armenian Church conformed to the doctrines of the Greek Church it ever after maintained its independence of both the Eastern and the Western churches. The Armenian Church accepts the canons of the first three General Councils of the Christian Church, as formulated at Nicea, Constantinople and Ephesus, but it possesses a longer creed peculiar to itself. The seven sacraments, prayers for the dead and the use of the 5th century version of the Scriptures made by St. Mesrob and others are all features of Armenian belief. To-day the Armenian Church is active wherever Armenians are to be found, particularly in Turkey, Russia, Egypt and on the American continent.

**The United States.** The Armenian Church in the United States is connected with the Armenian

Churches in Europe, Asia and Africa, and is under the same Catholicos. The Church originated in 1889, when Hovsep Sarajian, an Armenian priest from Constantinople, was sent to minister to a few hundred Armenians in Massachusetts. A church was built at Worcester, Mass., in 1891, which has since become the headquarters of the Armenian churches now scattered in that state, and later in Michigan, California, New York, Illinois, Wisconsin, Connecticut, New Jersey, Pennsylvania and Rhode Island. Sarajian was made archbishop in 1903. The churches follow the Gregorian calendar.

**ARMENIAN LANGUAGE**, a language of the *satem*-group of the INDO-EUROPEAN linguistic family, of which it forms an independent branch, written in an alphabet of 36 characters whose derivation is disputed though they are evidently mainly Greek. The language is first attested historically in the 5th century A.D. in a single dialect, probably that of the area around Lake Van; and although some of its sounds and certain grammatical features suggest South Caucasian influence, these seem to be independent parallel developments. It has seven cases and three tenses, but no grammatical gender; and the presence of a heavy stress-accent has resulted in sweeping phonetic changes. The vocabulary is so extremely mixed, even in the Classical period, that only about 25% is known to be genuinely Armenian, the remainder being borrowed chiefly from Syriac, Greek, Persian, and Parthian. (*See* separate articles on these subjects.) Traces of colloquial language and of dialects appear in the 11th century with Cilician Armenian; and the modern language falls into three dialectic groups, especially Western (Turkish) and Eastern (Russian), with extreme transformation of the old grammatical system.

L. H. G.

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**ARMENIAN LITERATURE** is divided into Classical and Modern Armenian. There was a pagan Armenian literature, the works of which were destroyed by the Christian priests, and there were songs and legends written in the first centuries of the Christian era; but the previous form of writing was superseded at the end of the 4th century when an Armenian alphabet was invented by Mesrob or Mesrop, and with Mesrop's alphabet Armenian literature really begins. One of the first works to appear in the new form of writing was a translation of the Bible, completed by 410. The first outstanding original work in Armenian was a *History of Armenia* by Moses of Khorene in the 5th century. The next notable writers were Lazarus of P'arb, a 5th century historian, and Eznig or Eznik of Golp, 6th century, who wrote a *Refutation of Heresies*. Numerous translations were made and many theological and historical works written, but the next conspicuous

writer was John VI Catholicus, at the end of the 9th century, a theological commentator and hymn-writer. The 12th century was one of unusual literary activity, producing as its greatest figure Nerses the Gracious, a poet and commentator. Theological and historical works continued to be written, and in 1565 a new impetus was given to Armenian literature by the establishment of an Armenian press in Venice, Italy, to be followed by others in Milan, Amsterdam, Leipzig and elsewhere. Since 1850 there has been an ever-increasing activity in Armenian letters, and a considerable body of promising work has been produced by modern and contemporary authors.

**ARMENIAN MASSACRES.** See **ARMENIAN QUESTION.**

**ARMENIAN QUESTION.** The Armenian Question had its origins in the treaties of San Stefano and Berlin which followed upon the Russo-Turkish War of 1877-78. The Russians occupied some of the Armenian provinces, and Russian nihilism soon made numerous converts among the sturdy Armenian people. In 1885 an Armenian revolutionary society was founded at Hunchak, and in 1890, another at Daschnak. The revolutionary patriots expected the aid of Britain in their designs to break away from Turkish misrule and so were led to commit a number of acts of a disloyal nature. In Aug. 1894, accordingly, on the pretext of putting down a local revolt at Sasun, a systematic massacre of Armenians by the Kurds was instigated by Sultan Abdul Hamid II. The area of massacres soon spread, and in Oct. and Nov. 1895, there were butcheries at Trebizond, Erzerum, Bitlis, Kurun, Marash, and elsewhere. In Aug. 1896, a group of twenty radical Armenians attacked the Ottoman Bank in Constantinople, with the inevitable result that a wholesale massacre of Armenians in the capital commenced. From 4,000 to 6,000 unfortunates were killed, while the foreign representatives enabled the foolish instigators to escape. Although the Armenians put up gallant fights on occasion, at Diarbekr, for example, and at Zeitun, it is estimated that between one and two hundred thousand of them were killed by the end of 1896. Even then the massacring came to a temporary halt only because of the presence of an international fleet at Constantinople, and the conciliatory tactics of the Patriarch, Ormanian, who had just become head of the Armenian church, and some of the sultan's higher Armenian officials.

When the Young Turks came into power in 1908 it was hoped that the lot of the Armenians, who still were periodically swooped down upon by Kurdish tribesmen, might be improved. But in 1909 new massacres occurred in Adana and elsewhere, and thousands more perished. Intermittent attacks continued during the following years, to be climaxed by another general slaughter of Armenians in Turkey in June and July 1915 after the Armenian soldiers at Van had resisted ill-treatment at the hands of Turkish troops and officers. A Russian invasion of 1916, further massacres in 1919, and an unsuccessful attempt to establish an independent republic in 1920, added

more bitterness to the already overflowing cup of Armenian misfortunes. Finally, in 1922, Armenia as part of the Transcaucasian Socialist Federated Soviet Republic became, for all practical purposes, a member of the Soviet Union. Thus a period was put to the Armenian massacres and question. W. C. L.

**ARMENOID**, division in anthropology. See **RACES OF MANKIND: Caucasoid Group.**

**ARMISTICE DAY**, the anniversary of the signing, November 11, 1918, of the armistice between the Allies and Germany, terminating hostilities in the World War.

**ARMORICA** (or **AREMORICA**), the Roman name given to the northern part of France between the Seine and the Loire rivers, and later applied to what is now Brittany. It was the country of the Amorici. In the 5th century some Celtic tribes from Britain crossed the channel and settled here. Their dialect is traced to the modern Breton.

**ARMOR PLATE.** Naval armor plate is of tough, hard steel of special composition. Plates of considerable thickness are forged, but thinner plates are generally made by rolling. Armor is given a special heat treatment to improve its physical characteristics. It has been found best in thicker plates to confine the principal hardening to the face while preserving a softer and less brittle back; but thinner plates are made homogeneous. Sample plates from each lot are tested by actual firing. Armor manufacture requires such elaborate equipment that only a few of the larger steel companies have the equipment to make it.

**ARMOR PROTECTION OF WARSHIPS.** As armor sufficiently thick and extensive enough to protect all parts of a ship would be impractically heavy, it is usual to leave many parts with no protection and by this means save sufficient weight to permit putting really effective armor over the vitals. Parts generally protected are magazines, conning towers, machinery spaces, boiler rooms, steering-engine rooms, barbettes and turrets.

The principal armor protection consists of the vertical, or nearly vertical, armor along the sides and running across the ship, and the horizontal armor covering the top of this box-shaped enclosure and consisting of one or more protective decks located close to the water-line. The portion of the side armor extending below the water-line generally is tapered to a reduced thickness because the deeper the impact, the more protection is afforded by the water. Side armor not exactly vertical but inclined outboard about 10° at the top often is used, as it is more effective because it makes the impact more oblique. The armor belt frequently is not on the ship's side but somewhat inboard, as this saves weight by decreasing the area of the protective deck and permits keeping the torpedo protection outboard of the armor. If fuses act very quickly, armor located inboard will not be struck by intact projectiles. Some of the fuel is often so located as to assist the armor in affording protection. Side armor runs up to 13 or 14 ins. thick-

ness of capital ships, while deck armor generally is less than 6 in. thick. At any particular range, side armor is least effective when the enemy fires at it exactly from abeam and hence at minimum obliquity, but at extreme range, thick side armor generally cannot be penetrated. On the other hand, protective decks furnish complete protection at the shorter ranges but at extreme range are generally penetrable by plunging fire. As a rule then, decks should suffer most at long ranges and sides more at shorter ranges.

G. L. S.

**ARMOUR, PHILIP DANFORTH** (1832-1901), American merchant, was born at Stockbridge, New York, May 16, 1832. In 1875 he became the head of the firm, later known as Armour and Company, founded by his brother, H. O. Armour. His son Jonathan Ogden Armour carried this business on after his death making it one of the largest in the world. P. D. Armour founded the Armour Institute of Technology at Chicago and built the Armour flats for the purpose of supplying homes for working people at a low rental. He died at Chicago, Ill., Jan. 6, 1901.

**ARMOUR INSTITUTE OF TECHNOLOGY**, a technical school in Chicago, Ill., founded in 1892 by Philip D. Armour. Its aim is to provide young men with a practical education. Although not a free school, the institute is broadly philanthropic in its scope. It gives courses in mechanical, electrical, civil, and chemical engineering, and architecture, in co-operation with the Art Institute of Chicago. The institute holds evening classes during 30 weeks of the year, and maintains a summer school. It is privately controlled and well-endowed. The property is valued at over \$5,000,000. The library contains 35,000 volumes. In 1931-32 there was a student enrollment of 830, with a faculty of 78, headed by Pres. Howard M. Raymond.

**ARMS AND ARMOR**, weapons of offense and equipment for defense, were used by primitive man in the earliest stages of his development. The use of



COURTESY AMER. MUS. OF NATL. HISTORY

DAKOTA INDIAN SHIELD

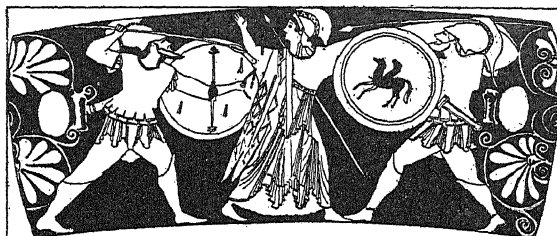
stone weapons was practically universal among the early races of man and these were developed into knives or daggers with handles and decorations. For arrow heads, flint was the material most commonly used, but weapons were also fashioned of bone and horn.

The shield was the earliest form of armor. With the advent of the Bronze Age came daggers, swords and shields of this metal,

often elaborately ornamented. Both bronze and iron were used for swords several centuries before the Christian Era. The early Greeks and Romans had bronze armor such as helmets, cuirasses, greaves and shields,

and their most important weapons, especially spears and swords, were also of bronze.

In the 12th century, at the time of the Crusades, the crossbow was used, and the development of ar-



GREEK ARMOR

Segment of a vase in the British Museum

mor was rapid. In England, with the Norman Conquest, the iron period of defensive armor began. At this time iron was already being used on the continent for defensive purposes. Because of the difficulty of obtaining and working metal, quilted fabric and leather were frequently used for protection. Later fabric and metal were combined to give the pliant and serviceable scale armor, having the scales sewed overlapping on a leather or quilted garment. Other varieties of early armor include the trellice coat, ringed armor, and chain mail.

The defensive armor at the time of the Conquest consisted of a linen undergarment called a tunic; the gambeson, a quilted garment worn under the hauberk, the chief body defense; and the jupon, or surcoat. The leg defenses were sometimes of leather and sometimes of mail, closely resembling the modern puttee.

As the manufacture of mail progressed the whole person of the wearer came to be protected by it. The body covering was extended to protect arms and legs, and a coif or hood of mail protected the head and neck. The surcoat worn over the mail kept the sun and rain from the armor. This frequently bore the armorial bearings of the wearer, a necessary cognizance when the knight wore the barrel helm. The helmets were flat or round topped; some in one piece, pierced for sight and air; others had movable ventails. The shields were of wood, large and round, or kite-shaped and the swords were longer and heavier.



KNIGHT IN ARMOR

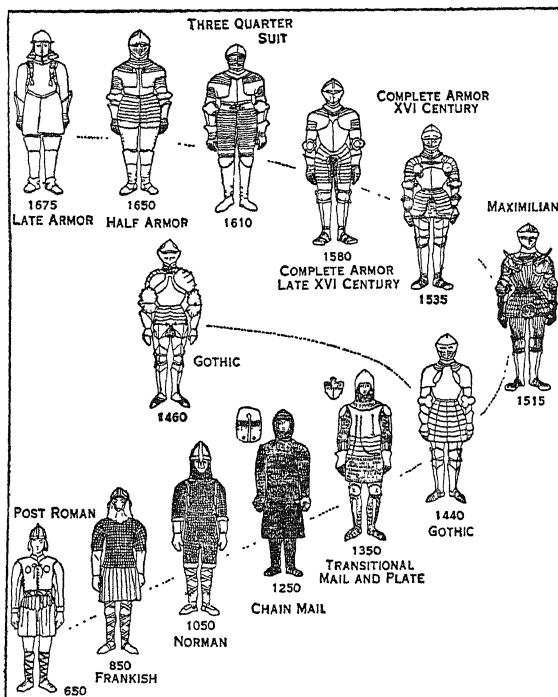
An effigy of a 13th century English knight, Sir William de Bruce, in the church of Pickering, England

During the 14th century, iron, leather, whalebone and quilted fabrics were all used for defensive purposes. Plate mail was introduced at this time, and by the end of the century many knights were in plate from head to foot. The long surcoat was shortened, and the great helm was replaced by a basinet with a movable visor. Full armor during the latter half of this century included a rounded breastplate and a backplate over the hauberk. Arms, legs and feet were cased in steel or studded leather. The shields presented an infinite variety in shape and decoration. The principal staff weapon was the lance, sharp for active service and blunted for tournaments. Other

sure hold for cutting or thrusting weapons. The thickness of the armor was graduated, the parts that were the most fully exposed being the thickest. The suits were constructed so that they would not hinder movements in walking, riding and fighting.

Armor of the 16th century, while continuing the perfection of the previous century, became more and more highly decorated. The Maximilian period of armor, from 1500 to 1540, was distinguished by the radiating fluted channels that spread from a central point in the breastplate. This suit was heavier and more clumsy than the earlier mail. It was during this period that the first traces of the decadence in armor which followed the 16th century were found.

The perfection of the musket and the new strategy



COURTESY METROPOLITAN MUSEUM OF ART

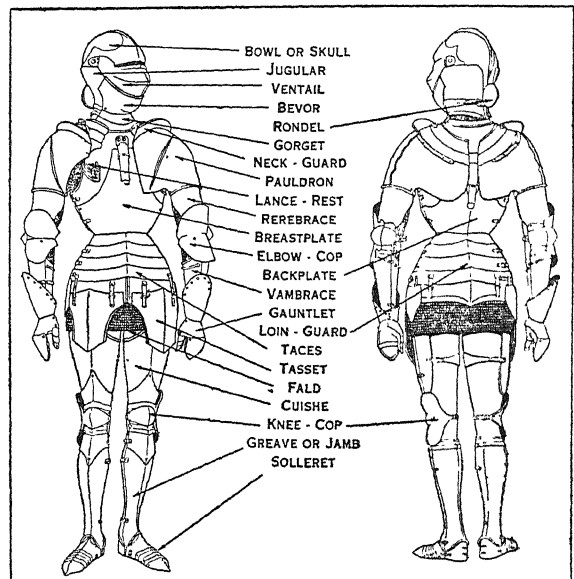
EUROPEAN ARMOR FROM 650 A.D. TO 1675

weapons were divided into those for stabbing and those for cutting.

As the weapons of the time became more formidable, armor increased in weight. The use of the longbow and the crossbow marked distinct periods in the development of defensive armor. With the introduction of and improvement in firearms, armor became thicker and heavier to enable it to withstand the impact of bullets.

The 15th century brought in the finest period of armor. The surcoat was generally discarded as was the horseman's shield, except at jousts and tourneys. The horse was protected with armor to match his rider, with solid plate reaching to his quarters. The knight was encased in plates with no chain mail visible.

Armor was produced in a great variety of forms. Of great importance in the improved armor was the "glancing surface," the rounded surfaces giving no



COURTESY METROPOLITAN MUSEUM OF ART

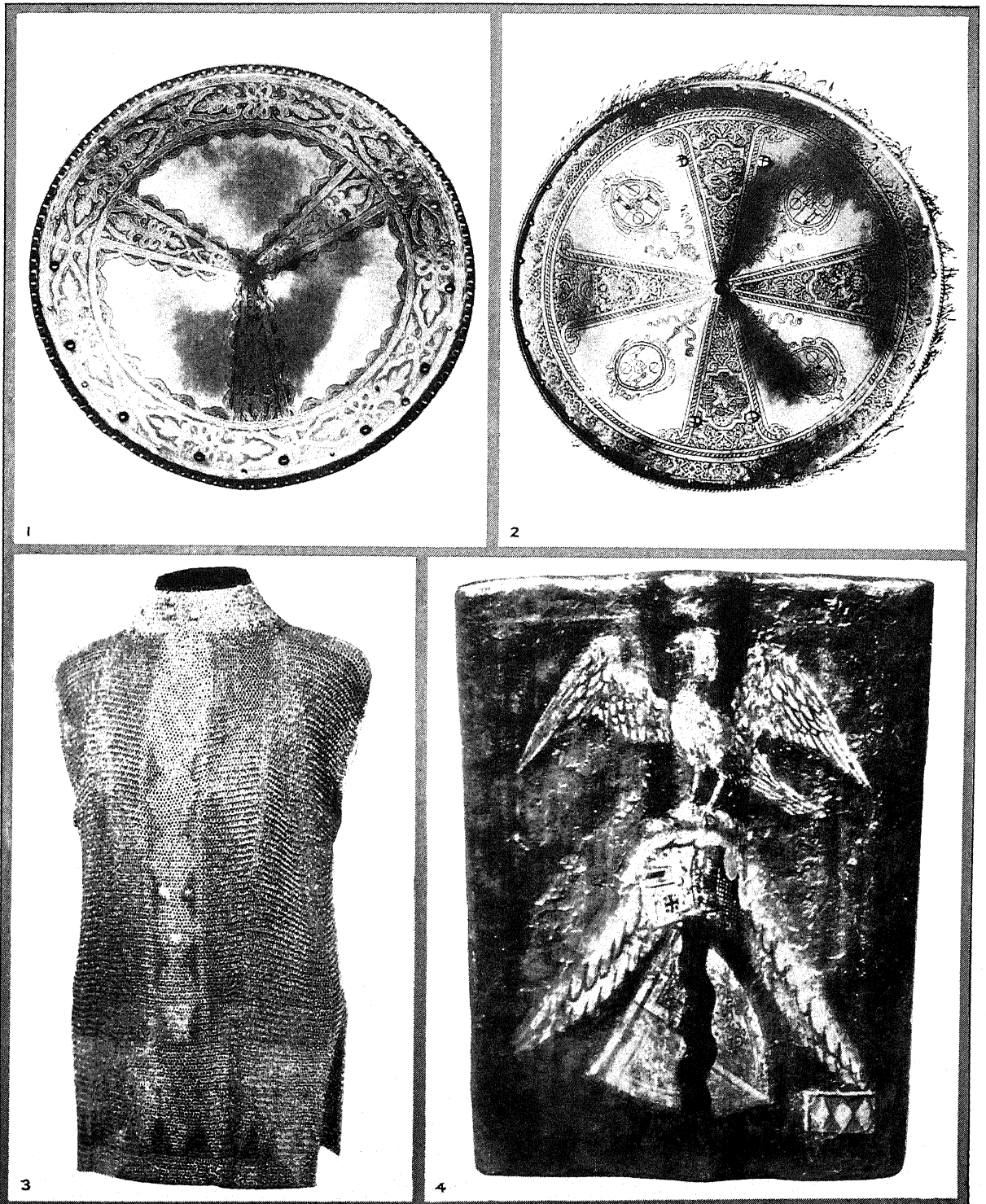
COMPLETE SUIT OF EUROPEAN ARMOR OF THE SECOND HALF OF THE 15TH CENTURY

in battle which called for long marches and rapid movements of armies gradually drove plate armor from the field. The new mode of warfare called for a less cumbersome garb, and with the exception of certain uniforms which still bear traces of armor, coats of mail were completely discarded after the 17th century. During the reign of Queen Victoria, plates were restored to her guardsmen for parade purposes. In the World War some of the helmets used approached those of the 15th century, and in the same conflict some use was made of a bullet proof body armor.

**ARMS TRAFFIC**, the sale, especially by private parties, of war arms and ammunition to backward peoples. Realizing that the traffic tends to stimulate internal strife and to encourage resistance to colonial rule, the powers have sought by international agreement at one time or another to prohibit or restrict it. The problem received fresh attention at the close of the World War on account of the large surplus of arms on hand. In June 1925 a multilateral conven-



## ARMS AND ARMOR



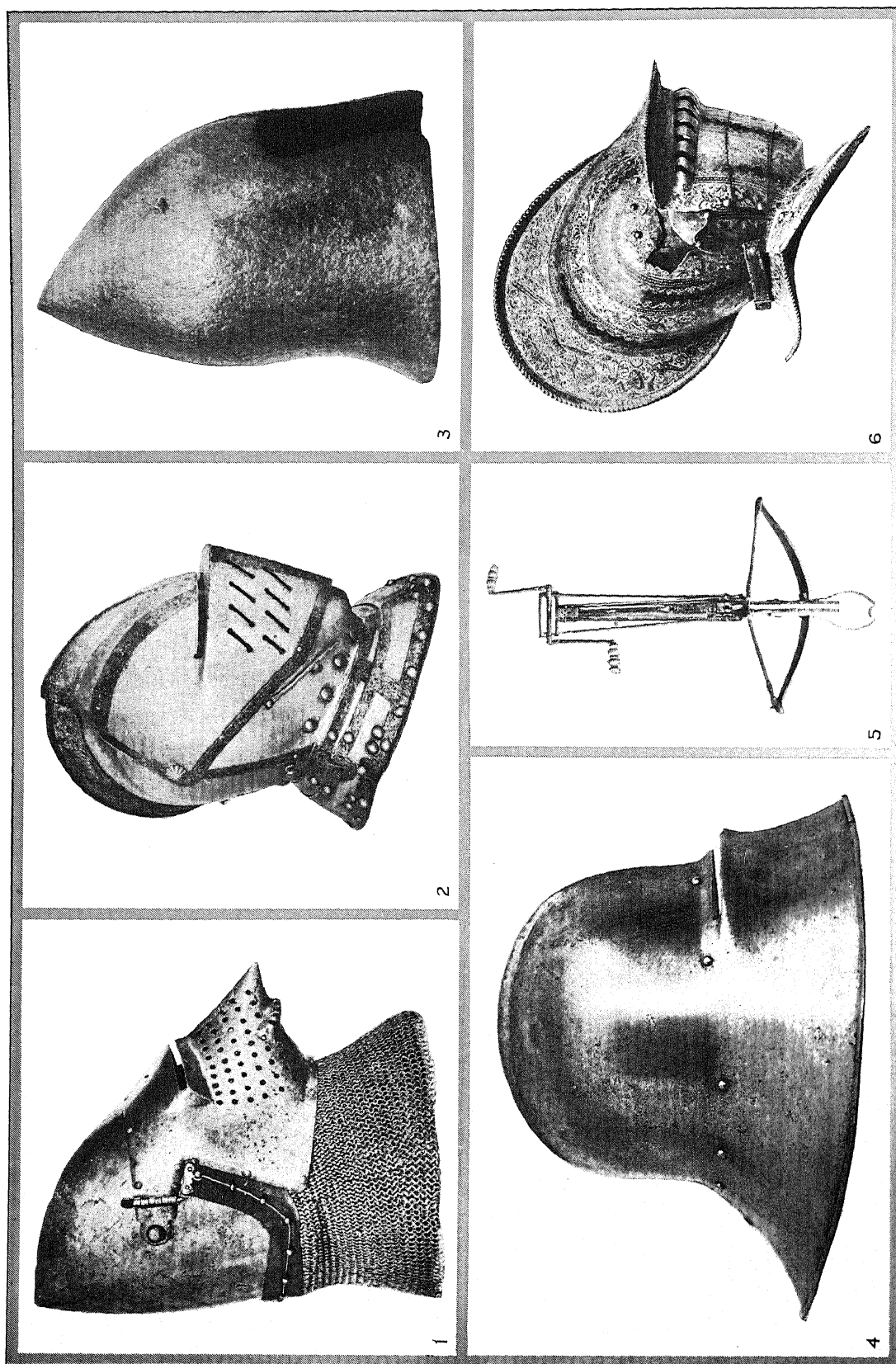
COURTESY METROPOLITAN MUSEUM OF ART

### SHIELDS AND MAIL OF THE MIDDLE AGES

1. German shield probably made by Wolf of Landshut for the Spanish court, about 1550. 2. Italian rondache or shield, about 1560. 3. Polish chain ring mail with

double steel latten mail collar and ornamental rivet heads, late 16th century. 4. Shield with the arms of the Behaim family of Nuremberg, about 1450.

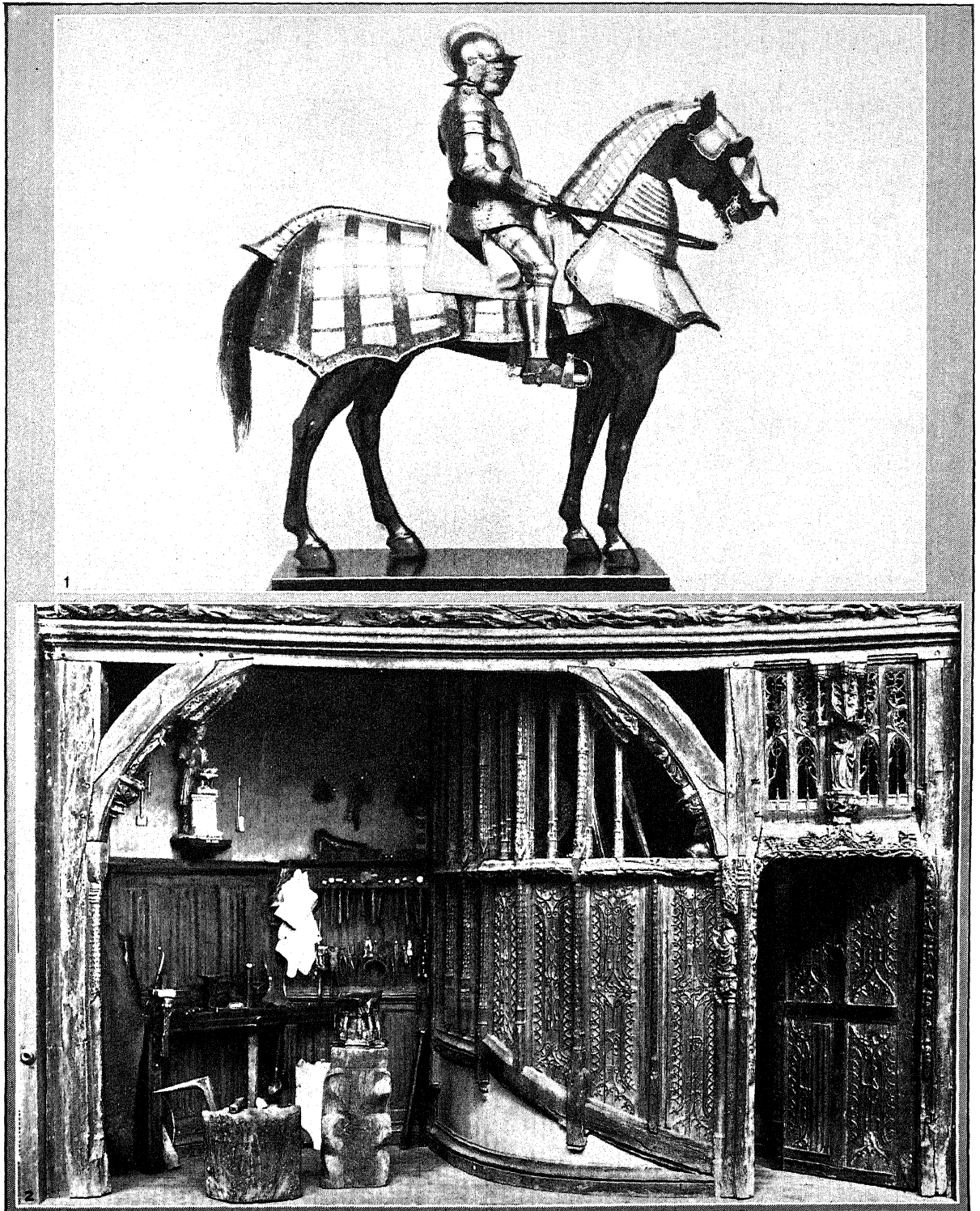
# ARMS AND ARMOR



## TYPES OF OLD EUROPEAN ARMAMENT

1. Bassinet with camail, late 14th century Italian.
2. Armet with etched decoration, late 16th century German.
3. Bowl bassinet made in one piece, 14th century Italian.
4. German salade, about 1480.
5. Windlass crossbow, German 16th century.
6. French burgonet, about 1550.

## ARMS AND ARMOR



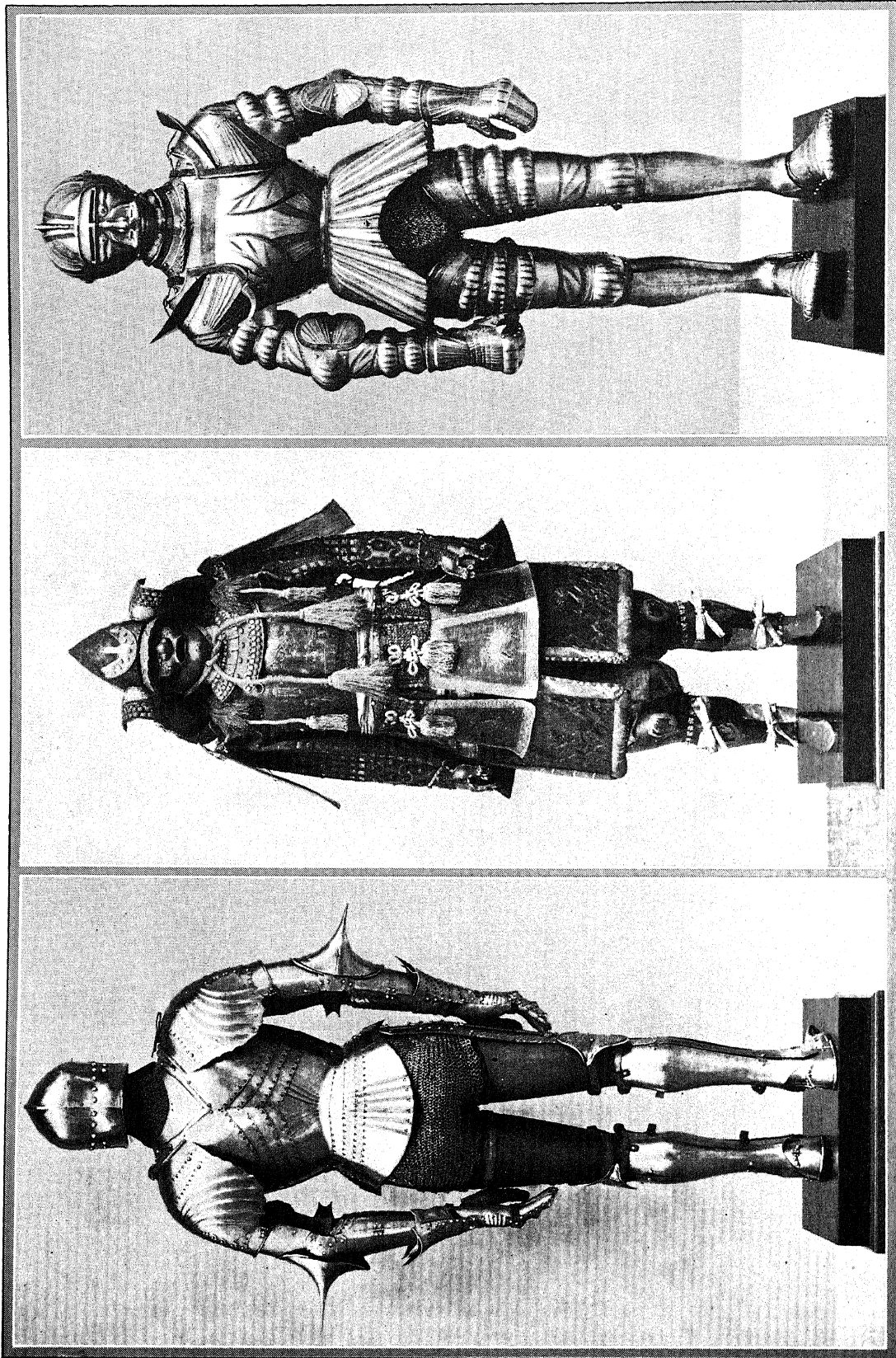
COURTESY METROPOLITAN MUSEUM OF ART

### ARMORED HORSEMAN AND AN OLD ARMORY

1. North Italian armor from the Palazzo Vendramini, and horse armor from the Castle of the Counts of Collalto, Treviso.
2. A restoration of a 16th century armorer's shop from Abbeville, France, showing work bench and tools.



## ARMS AND ARMOR



COURTESY METROPOLITAN MUSEUM OF ART

### ITALIAN, JAPANESE AND GERMAN ARMOR

1. Italian plate armor, dating from about 1480. Rear view.
2. Japanese armor etched and damascened with gold, silver, pewter, copper and iron. 16th to 19th centuries.
3. 10th century German suit of armor.

tion was held at Geneva and the articles signed were sent to the various powers for ratification. F. M. R.

**ARMSTRONG, SAMUEL CHAPMAN** (1839-93), American educator, was born in Hawaii, Jan. 30, 1839. He graduated in 1862 from Williams College and then served in the Civil War, advancing to the rank of colonel. He was afterwards employed in the Freedman's Bureau as superintendent of 10 counties in Virginia. In 1868 Armstrong founded and became principal of the Hampton Normal and Agricultural Institute for educating Negroes according to a system of combined labor and study. Later Indians were admitted as students. Armstrong died in Hampton, May 11, 1893.

**ARMSTRONG, SIR WILLIAM GEORGE** (1810-1900), English inventor and manufacturer, was born at Newcastle, England, Nov. 26, 1810. His inventions of an improved hydraulic engine and a hydraulic crane in 1840 and 1845, led to the building of the Elswick Engine Works at Newcastle for their manufacture. He later began to manufacture firearms and invented the first rifled ordnance gun which is known as the Armstrong gun. He was knighted in 1859. He died at Rothbury, Dec. 27, 1900.

**ARMY**, a unit of military organization, discussed in regard to its three different forms in the following paragraphs.

1. All the troops engaged in a particular enterprise.
2. A tactical organization acting alone or forming part of a larger force. In this application of the term, a numerical or geographical designation is generally given as the Army of the Potomac, the American First Army. The army in this sense is the largest self-contained unit. It consists of a commander with a staff, specialized army troops and services, and two or more Corps. To these may be added a special assignment of G.H.Q. (General HEADQUARTERS) aviation, G.H.Q. (General Headquarters) reserve artillery, cavalry divisions and other auxiliary troops, varying in number and composition according to the task assigned. The army is the fundamental unit of strategical maneuver. It has territorial, tactical, administrative and supply functions. The army commander plans and carries out the broader phases of tactical operations necessary to execute the strategical mission assigned him by the commander-in-chief. He initiates operations by giving orders to the commanders of corps and other large units directly under his command and to the chiefs of the army services.
3. All of the armed troops of a nation. By the National Defense Act, the Army of the United States consists of the regular army, the NATIONAL GUARD and the ORGANIZED RESERVES. The regular army consists of the INFANTRY, CAVALRY, FIELD ARTILLERY, Coast Artillery (*see* COAST DEFENSE) Air Corps and Corps of Engineers which are designated as the combatant arms of the line of the army; the General Staff corps; Adjutant General's department; Inspector General's department; quartermaster corps (*see* QUARTERMASTER CORPS, U.S. ARMY); Finance department; Medical department (*see* MEDICAL SERVICE); Ordnance

department; Chemical Warfare Service; the officers of the Bureau of Insular Affairs; the officers and enlisted men under the jurisdiction of the Militia Bureau; the chaplains; the professors and cadets of the UNITED STATES MILITARY ACADEMY; detached officers and enlisted men and unassigned recruits; Indian scouts; and officers and enlisted men on the retired list (*see* ACTIVE LIST). Except in time of war or other emergency, when the public safety demands it, the number of enlisted men is limited by law to 280,000, including the Philippine scouts. The actual strength of the army in enlisted men is limited by the annual appropriation bills to about 125,000. Enlistments are for a period of one or three years, at the option of the recruit, and reenlistments are for a period of three years.

The National Guard consists of the organized land forces of the various states, territories and the District of Columbia. The Organized Reserves are the great reservoir of officers for the war army of the United States.

A Reserve Officers' Training Corps, one or more units in number, is maintained at many of the colleges and universities where officers of the regular army are detailed as professors of military science and tactics. The minimum strength of units of infantry, cavalry and artillery is 100; of other units, 50. The average enrollment in the Reserve Officers' Training Corps exceeds 110,000.

The Citizens' Military Training Camps are designed to reach young men in isolated communities too small to support National Guard units. They also furnish an avenue for young men to enter the Officers' Reserve Corps who cannot approach it through the Reserve Officers' Training Corps. About 35,000 young men attend each year. On June 30, 1930, the total strength of the Officers' Reserve Corps, including 11,606 National Guard officers who held Reserve commissions (*see* COMMISSION), was 113,523. On the same date, the National Guard had an enrollment of 12,732 officers, 198 WARRANT OFFICERS, and 169,785 men. The number of enlisted men in the Reserve Corps was 3,323.

The organized peace establishment of the regular army, National Guard and organized reserves includes all the divisions and other military organizations necessary to form the basis of a complete and immediate mobilization for the national defense in the event of a national emergency declared by Congress. The law requires that the army be organized at all times into BRIGADES, DIVISIONS and army corps, and whenever the President may deem it expedient, into armies. For purposes of training, administration, and tactical control, the continental area of the United States is divided into nine corps areas. Each corps area contains at least one division of National Guard or organized reserves and such other troops as the President may direct. The corps areas are grouped into three army areas. Exterior to the United States proper are the Hawaiian, Philippine and Panama Canal departments. The troops in these corps areas

and departments are organized into tactical divisions and brigades and are commanded by major generals, who are under the direct command of the President as exercised through the Secretary of War. In the regular army, National Guard and Organized Reserves, the names, numbers and other designations, flags and records of the divisions and subordinate units that served in the World War between Apr. 5, 1917 and Nov. 11, 1918, have been preserved as far as practicable.

The President, as Constitutional Commander in Chief of the Army of the United States, exercises command of the army through the WAR DEPARTMENT. The Secretary of War, head of the War Department, transmits the orders of the President. He is assisted by two assistant secretaries, one for supply, real estate and war industrial plans, and one for military aeronautics, by a Chief of Staff, who holds the rank of GENERAL, and by a Deputy Chief of Staff, usually a major general. Under this combined direction, function the divisions of the General Staff, the chiefs of the arms and branches of the service and commanders of territorial departments and areas.

A general staff is an advisory body composed of specially selected officers who are qualified by long, wide and varied training to give the basic information and technical advice required in reaching decisions. The general staff of the War Department, composed of regular, National Guard and reserve officers, consists of five divisions. The G-1 division is concerned with personnel and man-power; G-2, with intelligence, local and world-wide; G-3, with operations of the army, particularly in education and training; G-4, with the housing and maintenance of the army; and war plans for plans of defense to meet possible contingencies. Functioning as advisers to the Secretary of War are the chiefs of Infantry, Cavalry, Field Artillery, Coast Artillery, Air Corps, corps of Engineers, Signal Corps, Chemical Warfare Service, Finance, Ordnance, Bureau of Insular Affairs and Militia Bureau; also the Adjutant General, Inspector General, Judge Advocate General, Quartermaster General, and Surgeon General.

In 1931 the number of commissioned officers of the regular army was limited by legislation to 12,000, which included one general, 21 major generals, 46 brigadier generals, 420 colonels, 577 lieutenant colonels, 1,585 majors, 3,150 captains, 2,967 first lieutenants, 1,771 second lieutenants, 983 officers of the Medical Corps, 158 officers of the Dental Corps, 128 officers of the Veterinary Corps, 72 officers of the Medical Administration Corps and 125 chaplains. There were approximately 2,940 infantry officers, including the officers of the Porto Rico regiment of infantry, 665 cavalry officers, 1,330 field artillery officers and 840 coast artillery officers. S. C. V.

**BIBLIOGRAPHY.**—Government Printing Office publications, *A Manual for Commanders of Large Units; The National Defense Act.*

**ARMY AND NAVY HOSPITALS.** See HOSPITALS, ARMY AND NAVY.

**ARMY AND NAVY JOINT BOARD**, a body composed of the Chief of Staff of the U.S. Army, the Deputy Chief of Staff, and the Assistant Chief of Staff, War Plans, representing the Army; the Chief of Naval Operations, U.S. Navy, the Assistant Chief of Operations, and the Director of the War Plans Division, representing the Navy; and a civilian permanent secretary.

The senior officer present presides over the meetings held at regular and special times. Questions of special import affecting both branches of the service are referred to the board by the Secretary of War and the Secretary of the Navy for consideration and report. R. E. C.

**ARMY GENERAL STAFF CORPS.** See GENERAL STAFF CORPS, U.S. ARMY.

**ARMY HEADQUARTERS**, the residence of the commander of troops whether in GARRISON or in the field and as such the center of his authority and the place from which his orders issue and where communications are directed. At headquarters are found the staff and clerical personnel and the necessary communication facilities. During active operations in the field it may not be advisable or practicable to move these entire headquarters far to the front, and when such a move is necessary the commander takes with him a small staff only and establishes a post of command (frequently referred to as a P.C.). Such a post has communication facilities established to enable the commander to be able to give all necessary instructions to and receive reports from his entire command. The headquarters of the United States Army is in the War Department, Washington, D.C.

**ARMY MEDICAL SERVICE, U. S.** The Medical Department of the U. S. Army includes at the present time the Surgeon-General of the Army, two assistant surgeon-generals, the Medical Corps, Dental Corps, Veterinary Corps, Medical Administrative Corps, Army Nurse Corps, and the enlisted men of the department. The Medical Corps has an authorized strength of 984 officers, commissioned in the grades from first lieutenant to colonel, inclusive. Promotion is based upon length of service, subject to professional examination.

The Dental Corps consists of 158 officers, and has the same grades and timed promotion as the Medical Corps.

The Veterinary Corps has 127 members, ranking from second lieutenant to colonel.

The Medical Administrative Corps consists of 72 officers, appointed from the enlisted strength and commissioned as lieutenants or captains.

The Nurse Corps numbers 600 in regular service, supplemented by more than 200 reserve nurses on active duty for the care of patients of the Veterans Bureau.

The enlisted strength of the Medical Department is 6,520 men, ranking from private to master sergeant.

The Medical Department, as an organized department of the Army having a general head has a continuous history since 1818. Prior to that, during the



Revolution and the War of 1812, there were heads and general organizations; but at the close of these wars, the few physicians left in the service were simply assigned to stations or regiments. In 1818 the Army was reorganized and a medical department was established.

Joseph Lovell became Surgeon-General. He required medical officers to submit quarterly and special reports upon medical subjects, and to record and report weather conditions at their stations. These latter reports were the beginning of our Weather Bureau.

The medical reports were the foundation for compilations of statistical reports of sickness and mortality of the Army, published in 1840 and later, which give most striking pictures of the diseases, the therapy and the hygiene of those days. The diseases recognized were mainly intestinal and respiratory infections, malaria, scurvy, venereal diseases and alcoholism.

Hygiene was negligible. The most important contribution in many years was Lovell's continued effort to reduce alcoholism, which finally resulted in the abolition of the rum ration. Lovell also gave all possible assistance to Surgeon Wm. Beaumont in his studies upon the physiology of digestion as observed through the gastric fistula of Alexis St. Martin. These studies constitute America's first contribution to scientific medicine.

Surgeon Thomas Lawson succeeded Lovell as Surgeon-General in 1836, and he was in office until the outbreak of the Civil War. He obtained military rank for medical officers, and stewards enlisted for hospital service.

The Mexican War showed the usual lack of preparation and of equipment for the Army and consequent great and needless suffering by the sick. However, ether anesthesia was in use during this war and it abolished much suffering and made for increase of surgery.

The Civil War broke upon a country wholly unprepared in a military sense. The Army consisted of 15,000 officers and men, the Medical Department of 107 officers, scattered from Maine to California, from Florida to Oregon. Before the close of the war, 12,343 doctors were to take part on the Union side alone. This war resulted in improvements in evacuation of the wounded and in military surgery, but the losses from infections and disease were very large.

After the war, the Army again became a small body, widely dispersed in small groups over the whole country, but mainly in the West and South. However, the Medical Department did notable things: the building up of the Library of the Surgeon-General's Office, and of the Army Medical Museum; the publication of the *Medical and Surgical History of the War of the Rebellion* and of the *Index Catalogue* of the Library. In 1888 the Hospital Corps was organized. (Medical Department enlisted men.) In 1893, George M. Sternberg published his *Manual of Bacteriology*. In the same year he became Surgeon-General and established the Army Medical School, probably the first school

of modern hygiene in America, as well as a school of military medicine.

The Army went to battle in the Spanish-American War provided with first-aid packets, with the result that the wounds, principally due to modern, steel-jacketed rifle bullets, healed mostly by first intention. But the morbidity and mortality from disease, mainly typhoid, malaria and dysentery, were great. The war left us with tropical possessions and faced by great problems of tropical hygiene. Boards for the study of tropical diseases were appointed in Cuba, Porto Rico and the Philippines, and there ensued a period of very great and notable progress. Yellow fever was practically abolished from America as the result of the work of the Cuban board, of which Major Walter Reed was president. The incidence of malaria in the Army fell from 708.52 in 1901 to 8.18 per 1000 in 1927, and the sickness from typhoid and dysentery in the World War was trifling in comparison with that of the Civil and Spanish-American Wars, as shown by the following figures:

	Case rate per 1000 in		
	1861-62	1898-99	1917-18
Typhoid and typhus . . . . .	70.69	91.22	0.34
Typho-malaria . . . . .	41.84	.	.
Fevers, undetermined . . . . .	.	27.00	5.93
Diarrhea, dysentery and intestinal diseases . . . . .	876.78	402.11	34.48

	Death rate per 1000 in		
	1861-62	1898-99	1917-18
Typhoid and typhus . . . . .	19.61	9.67	.05
Typho-malaria . . . . .	.94	....	....
Diarrhea, dysentery and intestinal diseases . . . . .	10.37	1.93	.08

The general improvement in sickness and death rates is shown by the comparison of figures for 1903 and 1927.

#### SICKNESS AND DEATH RATES

For the year 1903:

Admissions from disease . . . . .	1514.29
Admissions from all causes . . . . .	1716.51
Deaths from disease . . . . .	12.78
Deaths from all causes . . . . .	15.49

For the year 1927:

Admissions from disease . . . . .	526.78
Admissions from all causes . . . . .	644.24
Deaths from disease . . . . .	2.35
Deaths from all causes . . . . .	4.00

The Spanish-American War also taught us lessons as to preparedness, and in 1908 a Medical Reserve Corps was established. In 1916 the department, through the agency of the Red Cross, began the organization of reserve hospital and ambulance units. In consequence of these steps of preparation, the Medical Department was able to participate in the World War in advance of any other branch of the service.

This war demonstrated the unity of American medicine, and, under Surgeon-General Wm. C. Gorgas, a Medical Department outnumbering the entire army

of the Spanish-American War made a splendid record in the prevention and treatment of diseases. But it could not prevent great epidemics of measles, influenza and pneumonia, which worked sad havoc.

The Medical Department now maintains eight general hospitals varying in capacity from 200 to 1000 beds, and four professional schools. The schools are the Army Medical School, Army Dental School and Army Veterinary School, in Washington, D.C., and the Army Field Service School at Carlisle, Pennsylvania. See also EPIDEMIOLOGY; QUARANTINE.

P. M. A.

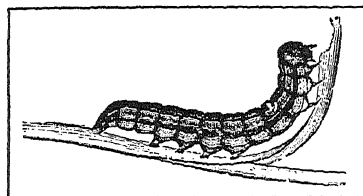
**ARMY SCHOOLS, U.S.**, include general service and special service schools. The general service schools are for the training of selected officers for command and staff duties, including the employment of all arms of the service. The special service schools are for the training of the officers in the various arms and services in the duties that pertain to their own individual branches. In general the graduates of these schools are selected to be sent to the general service schools.

The general service schools are the Command and General Staff School, Ft. Leavenworth, Kans.; the Command and General Staff Correspondence School, Ft. Leavenworth, Kans.; the Army War College, Washington, D.C.; the Army Industrial College, Washington, D.C.

The following are the special service schools: the Infantry School, Ft. Benning, Ga.; the Tank School, Fort Benning, Ga.; the Field Artillery School, Ft. Sill, Okla.; the Coast Artillery School, Ft. Monroe, Va.; the Cavalry School, Ft. Riley, Kan.; the Air Corps Primary Flying School, Randolph Field, Tex.; the Air Corps Advanced Flying School, Kelly Field, Tex.; the Air Corps Balloon and Airship School, Scott Field, Ill.; the Air Corps Tactical School, Maxwell Field, Ala.; the Air Corps Technical School, Chanute Field, Ill.; the Air Corps Engineering School, Wright Field, O.; the School of Aviation Medicine, Randolph Field, Tex.; Engineer School, Ft. Humphreys, Va.; Signal School, Ft. Monmouth, N.J.; Quartermaster Corps School, Philadelphia, Pa.; Quartermaster Corps Subsistence School, Chicago, Ill.; Quartermasters Corps Motor Transport School, Camp Holabird, Md.; Finance School, Washington, D.C.; Army Medical School, Army Medical Center, Washington, D.C.; Army Dental School, Army Medical Center, Washington, D.C.; Army Veterinary School, Army Medical Center, Washington, D.C.; Medical Field Service School, Carlisle Barracks, Pa.; Ordnance School, Watertown Arsenal, Mass.; Ordnance Specialists' School, Raritan Arsenal, N.J.; Chemical Warfare School, Edgewood Arsenal, Md.; Chaplains' School, Ft. Leavenworth, Kan.; Army Music School, the Army War College, Washington, D.C. For Navy schools see NAVAL SERVICE SCHOOLS, U.S. S. J.

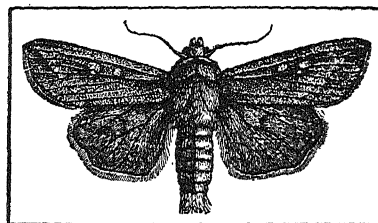
**ARMY WORM**, a species of cutworm (*Cirphis unipuncta*) of the family *Noctuidae*, whose larvæ feed at night, eating leaves and stalks of grasses and grains. When larvæ are very numerous, they may consume

all food in a given locality, after which great numbers of them may migrate in armies to other localities, devouring everything in their path. Adult moths have fawn-colored fore-wings with a distinct spot near the center. This insect is usually held in check by its insect enemies, and poisoned bait is also an



ARMY WORM LARVA

effective control measure. Other species of cutworms which sometimes assume the habit of marching in armies are likewise known as army worms.



ARMY WORM MOTH

**ARNE, THOMAS AUGUSTINE** (1710-78), English composer, was born at London, Mar. 12, 1710. His fame rests chiefly on his song *Rule, Britannia*, which appeared in the masque *Alfred*, produced in 1740. His wife, Cecilia Young, was a well-known opera singer, and his sister was the noted actress, Mrs. Cibber. Oxford University conferred on him the degree of Mus. Doc. He died at London, Mar. 5, 1778.

**ARNHEM**, capital of the Dutch province of Gelderland, lying on the Rhine River, 25 mi. east of Utrecht. Among noteworthy buildings are the *Groote Kerk*, completed 1452, the Princes' Court, where the dukes of Gelderland once resided, and the city hall, called the Devil's House. Arnhem has an art and other schools, a museum and factories which produce furniture, mirrors, scientific instruments; in the harbor there is active trade in grain, cattle and transit goods, particularly with Germany. Pop. 1930, 77,989.

**ARNICA**, the name of a large genus of plants of the composite family, comprising some 50 species, mostly native of northwestern America. The most important is the mountain arnica (*A. montana*), a perennial herb found in northern and central Europe. The stem, about 2 ft. high, rises from a tough, slender, brown rootstock, and bears a head of dark yellow gold flowers. The root yields an essential oil and also resinous, acrid-tasting, yellow crystals known as arnicin, from which is made a tincture used as a popular remedy for sprains and bruises.

**ARNO**, a river of Italy which rises in the Apennines on Mt. Falterona (4,260 ft.), flows south and then north and west. It divides Florence into two parts, washes Pisa, and falls 7 mi. below it into the Tuscan Sea, after a course of 155 mi. The river is navigable for barges up to Florence.

**ARNOLD, BENEDICT** (1741-1801), American soldier and traitor, was born at Norwich, Conn., Jan. 14, 1741. Although he was of fine Rhode Island stock, he received only a fair education and on two occasions ran away to join the military forces in the north. As a bookshop keeper and West Indies trader he prospered. He was married to Margaret Mansfield in 1767. In 1775 he distinguished himself as a soldier, and won Washington's regard. On Oct. 11, 1776, he vanquished the British on Lake Champlain, in the Revolution's first naval engagement, and in 1777 served brilliantly in both battles of Saratoga. Placed in command of Philadelphia in 1778, he was accused of misconduct, and although acquitted, as he had been of a similar charge in 1777, his resentment, added to the bitterness he already felt because of his tardy promotions, turned to vengefulness. In August, 1780, he obtained command of West Point, and entered into negotiations with the British general, Sir Henry Clinton, for its betrayal. The capture of the British emissary, Major André, on Sept. 21, disclosed Arnold's treason, but he escaped to a British warship and later went to England. He was commissioned a brigadier-general in the British army, and led two naval expeditions against the Colonials. In 1787-91 he renewed his West Indies trade, but found it increasingly difficult, on account of the war with France, to profit by it. Although he was materially rewarded by England, he was despised in England and America. He died in London on June 14, 1801.

See Newton, I., *Life of Benedict Arnold* (1880); also Bradford, Gamaliel, *Damaged Souls* (1922).

**ARNOLD, BION JOSEPH** (1861- ), American engineer and inventor, was born at Casnovia, Mich., Aug. 14, 1861. He received his technical education at Cornell University. He made a special study of electric traction and became associated with many traction projects, including the construction of subways in New York City, the rebuilding of the Chicago, Ill., street railway system and the electrification of the terminal of the New York Central Railroad in New York City. His chief inventions are in the field of electrical traction engineering.

**ARNOLD, SIR EDWIN** (1832-1904), English poet, was born at Gravesend, June 10, 1832. He studied at Oxford and taught at King Edward's School, Birmingham, before going to British India as principal of the Sanskrit College of Poona. Here he obtained the inspiration for his epic poem, *The Light of Asia*, 1879, in which the life and teachings of Buddha are set forth. On his return to England in 1861 he formed an association with the *Daily Telegraph* which lasted 40 years. He traveled extensively and wrote *Seas and Lands, East and West* and other poems. Arnold died in London, Mar. 24, 1904.

**ARNOLD, MATTHEW** (1822-88), English poet, critic and educator, son of Thomas Arnold, the famous headmaster of Rugby School, was born Dec. 24, 1822, at Laleham, Middlesex. He was educated at Rugby and at Balliol College, Oxford. In 1851 he was appointed an inspector of schools; in this work, which he carried on for 35 years, Arnold exercised a notable influence, especially in his strivings for finer ethics and more liberal ideals in education. From 1857-67 he was Professor of Poetry at Oxford, where his lectures attracted wide attention. It was as a critic and essayist, however, that Arnold was most distinguished. A man of wide reading and the highest tastes, he waged a brilliant battle for that SWEETNESS AND LIGHT which he held to be the chief aim of culture. No critic before had made high seriousness, morality, wholeness of spirit seem so vitally important or so attractive. Poised, urbane, yet singularly convincing, the essays include *Culture and Anarchy*, published 1869, *Literature and Dogma*, 1873, *God and the Bible*, 1875, *Last Essays on Church and Religion*, 1877, *Mixed Essays*, 1879, *Irish Essays*, 1882, and *Discourses in America*, 1885. Formerly judged as of minor significance, Arnold's poetry is now ranked with the most distinguished works of the VICTORIAN ERA. His two long poems, *The Strayed Reveller* and *Empedocles on Etna*, were published anonymously in 1849 and 1852, respectively. His fame as a poet rests even more, however, on his other poems, which include SOHRAB AND RUSTUM, *Tristram and Iseult*, *The Scholar Gypsy*, *Dover Beach*, *Rugby Chapel* and *Thyrsis*, the noted elegy on A. H. CLOUGH. In these he gave proof of his contention that good poetry is a "criticism of life." Arnold died at Liverpool, Apr. 15, 1888. See also ENGLISH LITERATURE.

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**ARNOLD, THOMAS** (1795-1842), English educator, was born at East Cowes, Isle of Wight, June 13, 1795. He studied at Corpus Christi, Oxford, and in 1815 became a fellow of Oriel. Later he spent nine years at Laleham preparing boys for universities. His greatest educational work was done at Rugby School where he became head master in 1828. Arnold brought new ideas to that institution, increased the enrollment and installed new branches of study. His sermons delivered there have been collected and published. In 1841 he was appointed professor of modern history at Oxford. Arnold was an ardent classical scholar and published an edition of *Thucydides* with geographical notes, and a *History of Rome*. He died at Oxford, June 12, 1842.

**ARNOLDSON, KLAS PONTUS** (1844-1916), Swedish writer, was born at Gothenburg, Oct. 27, 1844. He organized the Peace Conference Association of Sweden in 1883. The Nobel Peace Prize was awarded to him and F. Bajer in 1908. Among his works are *Ar varldsfred mojlig? (Is World Peace Possible?)*, 1891-92, and *Riket*, 1916. Arnoldson died at Stockholm, Feb. 20, 1916.

**ARNSTADT**, capital of the high district of the former German state, Schwarzburg-Sondershausen, about 10 mi. south of Erfurt, now part of the state of Thuringia. It has a palace with a collection of china and paintings, a fine tower, the Church of Our Lady with a Romanesque portal of the 10th century, and the Church of St. Boniface, where BACH was organist from 1703 to 1707. Copper and salt mines are in the vicinity and the city has trade in grains and livestock. Pop. 1925, 21,693.

**AROIDS**, a name formerly widely used, especially in Great Britain to designate the plants of the arum family (*Araceæ*). See **ARUMS**.

**AROMATIC COMPOUNDS**, derivatives of the hydrocarbon benzene ( $C_6H_6$ ), distinguished by the fact that the hydrogen is readily replaced by another univalent element or radical. Being of the benzene series, the aromatic compounds are of closed-ring structure and thus differ from the **ALIPHATIC**, open-chain or fatty series of **CARBON COMPOUNDS**, which are derivatives of **METHANE** ( $CH_4$ ). Most of the aromatic compounds are synthetic and are produced from the coal-tar products related to benzene. Only a small number of important aromatic compounds are derived directly from **COAL TAR**. These are termed "primaries" and when submitted to nitration, oxidation, chlorination, sulphonation and other chemical processes, "intermediates" are produced. Several hundred intermediates are obtainable and, by further treatment, finished dyestuffs (see **DYES**, **SYNTHETIC**) and related coal tar chemicals are produced in great numbers. Of the many primaries, the most important are **BENZENE**, **TOLUENE**, **NAPHTHALENE** and **ANTHRACENE**. These are separated from coal tar by fractional distillation and supplementary chemical treatment. The aromatic compounds are the most important and most numerous class of homocyclic compounds and are of fundamental importance in organic chemistry, most phases of that science being directly concerned with benzene and its derivatives. The name "aromatic" has its origin in fragrant oils containing benzene derivatives.

**AROMATIC SPIRITS OF AMMONIA**. See **AMMONIA**.

**AROOSTOOK WAR**, 1838-39, a clash over jurisdiction in the Maine-New Brunswick borderlands, which threatened war between the United States and Great Britain. The ambiguity of the **TREATY OF PARIS**, 1783, in defining the boundary between the United States and British North America gave rise to a serious situation in 1825, when lumbermen of Maine and of New Brunswick began to contest the right to cut timber in the disputed area. Canadian settlements on the Aroostook and Madawaska rivers were the subject of protest from the United States to Great Britain. Arbitration by the King of the Netherlands was agreed upon; the arbitrator, in Jan. 1831, declared the treaty definition "inexplicable and impracticable," and designated an arbitrary compromise line. The Senate refused its assent. From 1831-41, Palmerton's tenure as Minister of Foreign

Affairs in London, mutual distrust between the Minister and the United States prevented an adjustment. Overt acts by citizens of both countries in the disputed region became frequent. In 1838 an officer of the State of Maine, attempting to arrest some British lumbermen in the Aroostook valley, was himself arrested by New Brunswick authorities. The Maine legislature appropriated \$800,000 for military defense; Gov. Fairfield called out the militia and took possession of the disputed area. The Congress of the United States assigned \$10,000,000 and authorized the calling of 50,000 volunteers for the support of Maine. New Brunswick sent militia into the disputed district, and the neighboring province of Nova Scotia voted \$100,000 for the support of New Brunswick. President Van Buren despatched Gen. Winfield Scott to Maine; Fairfield was persuaded to withdraw his troops and await the outcome of diplomatic negotiations. These negotiations culminated in the **WEBSTER-ASHBURTON TREATY**.

**ARPEGGIO**, an Italian term used in music (derived from *arpa*, harp) which signifies a broken chord, or one in which the tones are played in rapid succession rather than simultaneously, since this type of chord is common in harp music.

**ARPHAXAD**, or **ARPACHSHAD**, is according to the traditions in the **BOOK OF GENESIS**, the third son of **SHEM** and grandson of **NOAH**. If his name is geographical rather than genealogical or ethnological, it is possible to connect it with Arrapachitis on the Zab, northeast of Nineveh. Some scholars have thought the name compounded of Arpach and Chesed. Others see in it Ur-pa-kesad, an Egyptian variant of the Hebrew Ur-Kasdim. Josephus identifies the name with the Chaldeans. The Bible makes only him a link between Noah and Eber, the ancestor of Abraham.

**ARRAIGNMENT**, a calling the defendant to the bar of the court to answer an indictment or information. It takes place by calling upon the accused by name, reading the indictment to him, demanding of him whether he is guilty or not guilty, and entering his plea upon the record.

**ARRAN ISLAND**, an oblong island in the county of Bute, Scotland, at the mouth of the Firth of Clyde. It is about 20 mi. long, 10 mi. wide and has an area of almost 166 sq. mi. Commercially, the island is important for its fishing and cattle. Its mountain landscapes are well known. Pop. 1921, 8,294.

**ARRAS**, a city in the department of Pas-de-Calais, northern France, situated at the junction of the rivers Scarpe and Crinchon, about 100 mi. north of Paris. A point of great importance during the World War, Arras was the scene of several hard-fought battles and was finally captured by the English in Sept. 1918; its monuments of art and most of its houses were destroyed by bombardments. Before the Roman rule, Arras was the principal town of the Atrebatas. In the Middle Ages the city was noted for its woollens, especially for a type of tapestry hanging which brought the term "arras" into use. Arras

now manufactures oilcake, dyes, iron, hosiery and other products. Pop. 1931, 29,490.

**ARRAS, BATTLE OF**, Apr.-May 1917, a British campaign in the WORLD WAR on a front of 15 miles extending from the northern end of Vimy Ridge to Croisilles. It marked the opening of an unsuccessful Allied offensive. The immediate objectives were the heights of Monchy-le-Preux, a position dominating the surrounding country, and Vimy Heights, one of the greatest German strongholds. The British employed the 1st, 3rd and 5th armies, and only 60 tanks. The German position was strongly entrenched, both as to machine-gun nests and reserves, numbering 600,000. Following a terrific four-day bombardment, the general attack opened on Apr. 9. The first-line German system, including a portion of Vimy Ridge, was captured. On Apr. 11 the British captured Monchy-le-Preux; but at this point the German resistance stiffened. By May 5 a total of 13,000 prisoners and 200 guns had been captured. The advance was then severely checked by the German reserves. The British losses were very heavy.

**ARREST**, in criminal law, the seizing or apprehending a person by lawful authority in order that he may be forthcoming to answer for an offense he is believed or suspected to have committed. At common law arrests may be made either by a private person or by a peace officer. A private person may arrest without warrant for felony, or upon suspicion of a felony actually committed in his presence, or in case a felony has been committed and there is reasonable ground for believing the person arrested has committed it, or in case of reasonable ground to believe a felony has been committed and that the person arrested was the perpetrator. As to the last proposition statutes have modified the law variously in many states. In case of misdemeanors at common law there could be no arrest without a warrant except where a breach of the peace was committed in the officer's presence. Thirty-seven states have now extended the power of arrest without warrant to all misdemeanors committed in the officer's presence.

**ARRÊT**, a term applied in modern times to the judgments and decisions of the courts and tribunals of France. Historically the term simply meant a decree or edict of a sovereign.

**ARRETUM**, also Aretium, the modern Arezzo, an ancient city of Etruria in Italy situated near the sources of the Arno and Tiber rivers. The Romans colonized the site three times; in the war with Hannibal Arretium was a base of Roman supplies and a number of its inhabitants joined Catiline during his conspiracy. Arretium is believed to be the birthplace of Maecenas, patron of Horace. A particularly fine red pottery ware made the city's name widely known, and in the country around wine and corn were produced. Only ruins of the ancient city remain.

**ARRHENIUS, SVANTE AUGUST** (1859-1927), Swedish chemist and physicist, was born at Schloss Wijk, near Upsala, Sweden, Feb. 19, 1859. Arrhenius presented a paper explaining his theory

of electrolytic dissociation to the Stockholm Academy of Sciences in 1883 which definitely associated his name with that subject. Other works which gained wide recognition for him were *Larabok i teoretisk elektrokemi*, *Lehrbuch der kosmischen Physik* and *Das Werden der Welten*. In 1903 he was awarded the Nobel prize for chemistry and two years later was appointed director of the Nobel Institute for Physical Chemistry, situated near Stockholm, holding this office until his death, Oct. 2, 1927.

**ARRIAN or ARRIANUS, FLAVIUS** (c. 96-c. 180 A.D.), a Greek historian born at Nicomedia in Bithynia. A pupil of EPICETUS, he published copious notes on his lectures, which give a clear picture of Stoic ethics. After a distinguished public career under the Roman emperor HADRIAN, he devoted himself to writing. His greatest work, the *Anabasis of Alexander*, is based on the accounts of Aristobulus and Ptolemy, officers of Alexander, and is consequently detailed and in the main reliable. He modelled his style upon XENOPHON.

**ARROWHEAD**, a genus (*Sagittaria*) of aquatic plants of the water plantain family, several of which are grown as ornamentals. There are about 30 species, natives chiefly of temperate and tropical America, most of which are found in the United States and Canada. They are smooth perennials, mostly with tuber-bearing root stocks, growing in shallow water, with long-stalked, usually arrow-shaped leaves and showy, white, buttercup-like flowers in terminal clusters. The Old World arrowhead (*S. sagittifolia*), 3 to 4 ft. tall, widespread in Europe and Asia, is cultivated in China for its starchy tubers used for food. The similar broad-leaved arrowhead (*S. latifolia*) is found almost throughout North America. It was formerly used as a food plant by the Iroquois Indians; the plant is now grown by the Chinese in California for its tubers locally known as tule potato. The giant arrowhead (*S. montevidensis*), 6 ft. high, native from Brazil to Argentina and widely grown as an ornamental, has run wild in California and the southeastern states.

**ARROW POISONING**. Prehistoric man added poisonous plant juices to his arrows. Pliny reports that the Gauls dipped arrows in hellebore; other tribes used aconite, yew and lineum. Scythian, Greek and Roman archers employed viper blood. In fact, the word toxikon, originally applied to arrows, give us toxic, meaning poisonous.

The American Indians used vipers, scorpions, pulverized bees, ants, and plant poisons, including *Yucca angustifolia* as arrow poison. In Asia, Africa and South America, savage tribes have characteristic arrow poisons, some of which still defy analysis. The best-known South American drug is curare, but 20 or 30 vegetable substances are used. African tribes employ both vegetable poisons, having as their base strophanthus and strychnine, and animal poisons, including reptilian products and those of human decay. The Javanese distill upas sap for darts; in the East Indies, cardiac depressants and strychnine-bear-

ing plants are used. China has a curare-like drug, India and the Ainus of Japan use a sort of aconite.

**ARROWROCK DAM** is located on the Boise River about 22 mi. east of Boise, Idaho. For many years after its completion this concrete structure, of arch-gravity type, extending to a height of 349 ft. above lowest foundation level and 270 ft. above river bed, held the record as the highest dam in the world. It is 223 ft. thick at the base of the deepest section and its top length is 1100 feet. It is of the non-over-flow type, the spillway being a separate structure at one end of the dam. The volume of masonry in the dam is 585,000 cubic yards. It creates an irrigation storage reservoir having a capacity of about 11 billion cubic feet.

**ARROWROOT** (*Maranta arundinacea*), a perennial herb of the maranta family widely grown as a food plant. It is a native of South America extensively cultivated in the tropics and naturalized in southern Florida. Arrowroot is an erect plant with branching leafy stems, 2 to 6 ft. high, large, oblong, pointed leaves and small, scattered, white flowers. The starchy rootstock is an important source of commercial arrowroot or tapioca. Similar preparations known as arrowroot are obtained from various other plants, especially from species of *Curcuma* and certain CYCADS (*Zamia*).

**ARROWWOOD**, the name given to various North American shrubs and small trees with straight stems or branches, used by the Indians for arrowshafts. A good example is the smooth arrowwood (*Viburnum dentatum*), a handsome shrub of the honeysuckle family, which grows in wet places from New Brunswick to Georgia. It produces from its roots a number of very straight stems, about the thickness of a lead pencil.

**ARSENAL**, a dépôt for manufacturing and storing ammunition and other military supplies, operated by the Federal or state government for the purpose of maintaining the noncommercial manufacture of weapons; or for preserving those on hand from deterioration and loss. Experimental work is carried on in connection with the development of new war equipment. The United States maintains arsenals at Watertown and Springfield, Mass., Watervliet, N.Y., Frankford, Pa., Dover, N.J. and Rock Island, Ill. See AMMUNITION DEPÔTS.

**ARSENIC**, a chemical element (symbol As, at. wt. 74.93) belonging to the ANTIMONY and BISMUTH group, closely related to phosphorus and nitrogen. It occurs in the free state, but is usually combined with other metals and sulphur. It has a silvery luster but tarnishes quickly. It burns in air and sublimes without melting. Its oxides and hydroxides are acidic. It will not displace hydrogen from dilute acids.

The oxides or salts of arsenic find a wide variation of uses both as insecticides and medicinals. See ARSENIC TRIOXIDE.

**ARSENIC TRIOXIDE**, the most common of the commercial medicinal preparations of arsenic. Arsenic trioxide ( $As_2O_3$ ) occurs as an opaque white powder,

slowly soluble in water, forming arsenous acid. When applied to denuded or ulcerated tissue it is caustic in action. It is a common ingredient in fake cancer cure nostrums. Taken internally, except in very small doses, it is exceedingly poisonous. In proper doses arsenic trioxide, or preparations of it, is employed in the treatment of neuralgia, chorea, pernicious anemia, leukemia, Hodgkin's disease. In these conditions, however, it is best administered in the form of solution of potassium arsenite (Fowler's solution). It is also powerful in certain protozoan infections, such as malaria, syphilis and relapsing fever. It is also known as arsenous oxide and white arsenic.

**ARSENOBENZOL**. See ARSPHENAMINE.

**ARSENOPYRITE**, the correct mineralogical name for the arsenical sulphide of iron popularly called MISPICKEL. In appearance it is metallic silver white to grayish white. It is an important ORE of arsenic, and often carries gold and cobalt. See also ORE DEPOSITS; ORPIMENT; REALGAR.

**ARSENOUS OXIDE**. See ARSENIC TRIOXIDE.

**ARSON**, "the malicious and voluntary burning of the house of another by night or by day," is Lord Coke's COMMON LAW definition. States in the United States regulate this offense by STATUTE, which generally covers the burning of one's own property, but where statute does not define, common law is followed. As arson is regarded more as an offense primarily against the security of life, it has always been considered a serious offense—in early times punished by death—and always at common law, regarded as a FELONY. The burning must be wilful and malicious, otherwise it is only a TRESPASS.

**ARSPHENAMINE**, the trade name for the arsenical preparations diamino-dihydroxy-arsenobenzene hydrochloride ( $C_{12}H_{12}O_2N_2As_2 \cdot 2HCl$ ), first introduced under the name of "606" by Ehrlich, who later gave it the more scientific name "salvarsan." In other countries it is also known as arsenobenzol, diarsenol and kharsivan. Arspenamine occurs as yellow crystalline hygroscopic powder, which must be carefully protected from air. Arspenamine is a specific remedy for syphilis in all infections, but is more efficient in recent infections. Before administration by injection, it is converted to the sodium salt. In Vincent's angina (trench mouth), local applications of arspenamine (hydrochloride) have been found useful in addition to the intravenous administration. Arspenamine is also used in pernicious malaria and other protozoan infections. Derivatives of arspenamine are neoarsphenamine, arspenamine silver and sulpharsphenamine.

P. N. L.

**ART**. See ASSYRIAN ART; BABYLONIAN ART; BYZANTINE ART; CHINESE ART; CHRISTIAN ART; EGYPTIAN ART; GOTHIC ART; GREEK ART; INDIAN ART; JAPANESE ART; JEWISH ART; MOHAMMEDAN ART; PERSIAN ART; PHOENICIAN ART; PRIMITIVE ART; RENAISSANCE ART; ROMAN ART; ROMANESQUE ART. See also PORTRAIT PAINTING; SCULPTURE; WATER COLOR PAINTING.

**ART, SCHOOLS OF**. Instruction in art in organized schools is a somewhat modern development.



In ancient times great artists had their own individual pupils; and in the Middle Ages the guilds in the European centers controlled both the arts and the trades. The Italian Renaissance brought back the pupil groups studying under a master, and there came into existence such schools as those of Raphael, Da Vinci, and Michelangelo. Some of the famous Dutch and Venetian artists also originated schools of this kind.

The first great organized school of art was the Académie royale de peinture et de sculpture, founded in 1648, one of several academies established during the reign of Louis XIV. L'Ecole des beaux-arts, properly l'Ecole nationale et spéciale des beaux-arts de Paris, is the successor of this first art school, and the greatest, as well as the oldest, school of art in existence. In England, the South Kensington schools of art, founded to advance the industrial arts, and the provincial schools were organized in the middle of the 19th century. In the United States there are a number of private schools, managed by boards of trustees, some of them connected with museums of art. There are also many universities and colleges which conduct special schools, or departments, of art. Among these are the University of Chicago, Yale University, the universities of California, Illinois and Kansas, and Boston University. Harvard University and Cooper Union have done much for art education; and the Carnegie Corporation, through its grants of money, has greatly aided its development in the United States.

For some time the teaching of art in schools was academic and formal. Little was left to the initiative of the pupils, little done to develop their capacity for self-expression. The change within recent years has been a marked one, and was naturally accompanied by rival methods and theories. Certain principles, however, seem to have evolved from the confusion. Among these are the development of the individual bent, the stirring of the imagination, and the teaching of free-hand drawing. The younger pupils in the public schools are, indeed, sometimes allowed to work out their own ideas with very little guidance; and the results are, not infrequently, surprising in their originality and power. In the modern school of art the underlying principle of instruction is free-hand drawing, with technique and principles of criticism taught through practice, lectures and exhibits. Original design is demanded of the pupils, and, in the public schools, at least, the project method is much used.

When art instruction is given in connection with academic courses it is somewhat difficult to gauge the pupil's progress, as his time and attention are, necessarily, divided between the various branches of study. None the less, both the teaching and the results are, upon the whole, excellent. Those, however, who wish to devote themselves wholly to the study of art have a number of prominent schools, both in Europe and America, from which to choose. Among these are: L'Ecole des Beaux-Arts of Paris; the Royal Academy of London; the Art Students' League and the Academy of Design, in New York, and the art

school of the Art Institute of Chicago. There are also summer schools, conducted by well-known artists; and there are artists who, as did those of former days, teach pupils in their own studios. This is especially the case in Paris, where certain French painters have carried on the great tradition.

**ARTEL**, a name applied in Russia to cooperative associations. The word *artel* is derived from the Turkish *orta*, meaning association. Historically, they were free and voluntary unions of private individuals for the collective achievement of economic ends. Thus there arose as early as the 14th century associations of fishermen, hunters, agricultural laborers, salt producers, masons, carpenters and many others. Since the inauguration of the New Economic policy (*see* RUSSIA), the Soviet Government has attempted to make use of this same form of organization as a first step in the socialization of small-scale production. There has in consequence been a tremendous increase in the number of these organizations in Russia, particularly in the field of agriculture. The modern cooperatives differ from the old, however, in that their organization is semi-compulsory, and in that they are subject to greater regulation by governmental authority. S. C. W.

**ARTEMIS**, Greek goddess and sister or wife of APOLLO, whose attributes she shares. Like Apollo, she is armed with a bow, quiver and arrows and sends plague and death among animals. Also she cures the sufferings of mortals. (*See* AENEAS.) She appears in various countries and in different forms. The Arcadian Artemis bears no relation to Apollo, but is a hunting nymph with a chariot drawn by four stags with golden antlers. It was another Artemis (*see* HECATE) who drove men mad, one of her victims being AJAX.

**ARTEMUS WARD.** *See* CHARLES FARRAR BROWNE.

**ARTERIAL SYSTEM**, the branching system of tubes that carries blood from the heart to the tissues of the body. In general arteries carry purified blood. The pulmonary artery, however, carries impure blood to the lungs to be oxygenated. (*See* CIRCULATION.)

All arteries except those in the pulmonary system are called systemic arteries, and arise ultimately from a large vessel, the AORTA, which in turn springs directly from the left ventricle of the heart. Thus the aorta begins in the upper part of the chest, and immediately forms a semicircular arch, so that it is directed downward after turning. (Fig. 1.) The aorta continues downward through most of the length of the trunk, sending off branches throughout its course, and finally divides into two vessels which, after giving branches to the pelvis and buttock, continue into the lower extremity of either side.

As the aorta forms the arch referred to, it sends off the vessels which supply the head, neck, shoulder, chest wall and upper extremity. The vessel which supplies the head is the common carotid, while that distributing branches to the remaining regions named is the subclavian. On the left side these two vessels

ARTERIAL SYSTEM

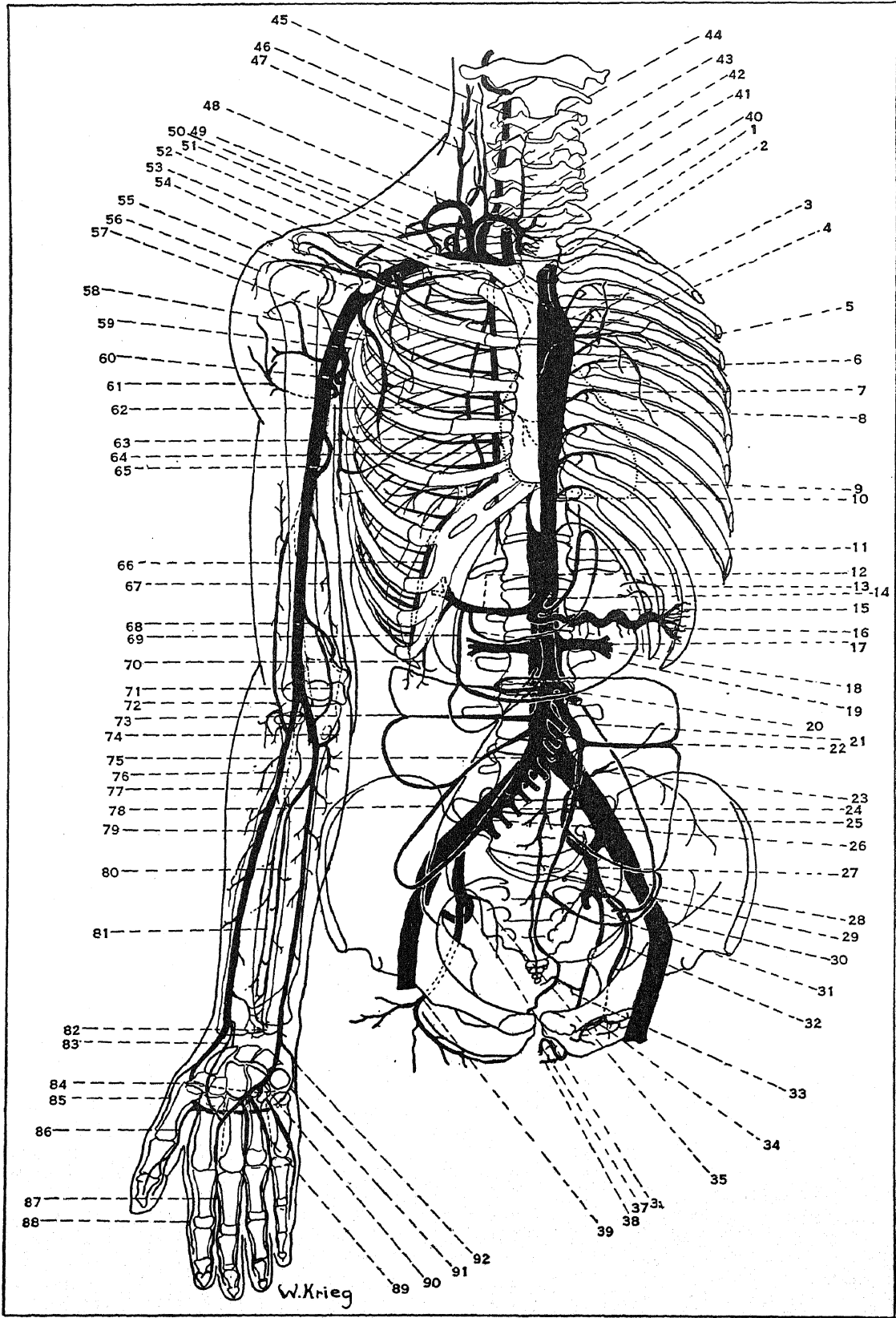


FIGURE 1

FIG. 1. ARTERIES OF THE TRUNK AND UPPER EXTREMITY

1, Left common carotid; 2, left subclavian; 3, arch of aorta; 4, bronchial; 5, aortic intercostal; 6, posterior branch of intercostal; 7, anterior branch of intercostal; 8, collateral branch of intercostal; 9, outline of heart; 10, thoracic aorta; 11, left gastric; 12, hepatic; 13, short gastric; 14, coeliac; 15, splenic; 16, terminal branches to spleen; 17, renal; 18, right gastric; 19, left gastroepiploic; 20, middle colic; 21, ovarian or testicular; 22, left colic; 23, iliolumbar; 24, intestinal; 25, common iliac; 26, superior mesenteric; 27, hypogastric; 28, middle sacral; 29, inferior mesenteric; 30, external iliac; 31, pudental; 32, obturator; 33, inferior hemorrhoidal; 34, obturator; 35, internal iliac; 36, superior gluteal; 37, dorsal artery of clitoris (or penis); 38, artery of urethral bulb; 39, inferior gluteal; 40, terminals to thyroid; 41, right common carotid; 42, inferior thyroid; 43, inferior laryngeal; 44, ascending cervical; 45, vertebral; 46, profunda cervicis; 47, ascending branch; 48, transverse cervical; 49, thyrocervical trunk; 50, costocervical trunk; 51, transverse scapular; 52, innominate; 53, subclavian; 54, acromial; 55, pectoral; 56, deltoid; 57, axillary; 58, lateral thoracic; 59, subscapular; 60, scapular circumflex; 61, posterior humeral circumflex; 62, pericardiazophrenic; 63, intercostal; 64, internal mammary; 65, profunda; 66, musculophrenic; 67, superior ulnar collateral; 68, inferior ulnar collateral; 69, gastroduodenal; 70, cystic; 71, anterior ulnar collateral; 72, radial recurrent; 73, right colic; 74, posterior ulnar recurrent; 75, superior mesenteric; 76, interosseus recurrent; 77, common interosseus; 78, ilcocolic; 79, radial; 80, volar interosseus; 81, dorsal interosseus; 82, volar ulnar carpal; 83, superficial volar; 84, dorsal carpal; 85, first dorsal metacarpal; 86, princeps pollicis; 87, digital; 88, volaris indicis radialis; 89, volar metacarpal; 90, superficial volar arch; 91, deep volar arch; 92, deep volar

FIG. 2. ARTERIES OF THE LOWER EXTREMITY

1, Superficial iliac circumflex; 2, ascending; 3, profunda; 4, first perforating; 5, descending; 6, second perforating; 7, third perforating; 8, superior muscular; 9, lateral superior genicular; 10, lateral sural; 11, lateral inferior genicular; 12, anterior tibial recurrent; 13, anterior tibial; 14, muscular; 15, peroneal; 16, perforating; 17, communicating; 18, anterior lateral malleolar; 19, dorsalis pedis; 20, lateral tarsal; 21, lateral plantar; 22, deep plantar arch; 23, dorsal metatarsal; 24, end of external iliac; 25, superficial epigastric; 26, superficial external pudental; 27, medial femoral circumflex; 28, deep external pudental; 29, muscular; 30, femoral; 31, muscular; 32, highest genicular; 33, popliteal; 34, medial superior genicular; 35, medial sural; 36, middle genicular; 37, medial inferior genicular; 38, posterior tibial; 39, muscular; 40, anterior medial malleolar; 41, posterior medial malleolar; 42, medial plantar; 43, arcuate; 44, deep plantar; 45, first dorsal metatarsal; 46, digital

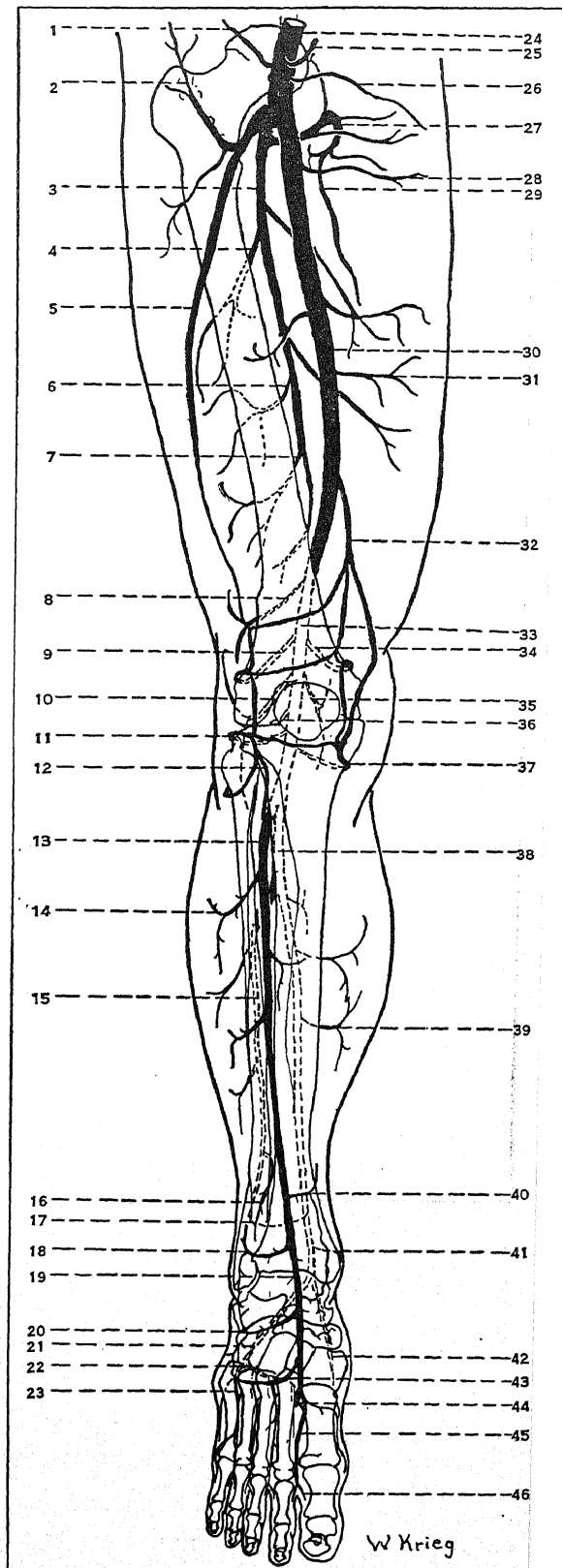


FIGURE 2

arise separately, but on the right side they are joined at their origin to form the innominate artery.

The common carotid artery of either side ascends the neck, lying at the side of the trachea and esophagus. A little below the angle of the jaw the vessel divides into external and internal carotid arteries. The in-

ternal carotid artery enters the brain-case and gives off branches to the brain, and to the eye and its surrounding structures. The external carotid artery continues vertically outside the skull between the jaw and ear and distributes branches to the face and scalp. There are eight primary branches. These with their divisions are shown in Fig. 3. The first branch is the superior thyroid, which supplies the anterior and upper part

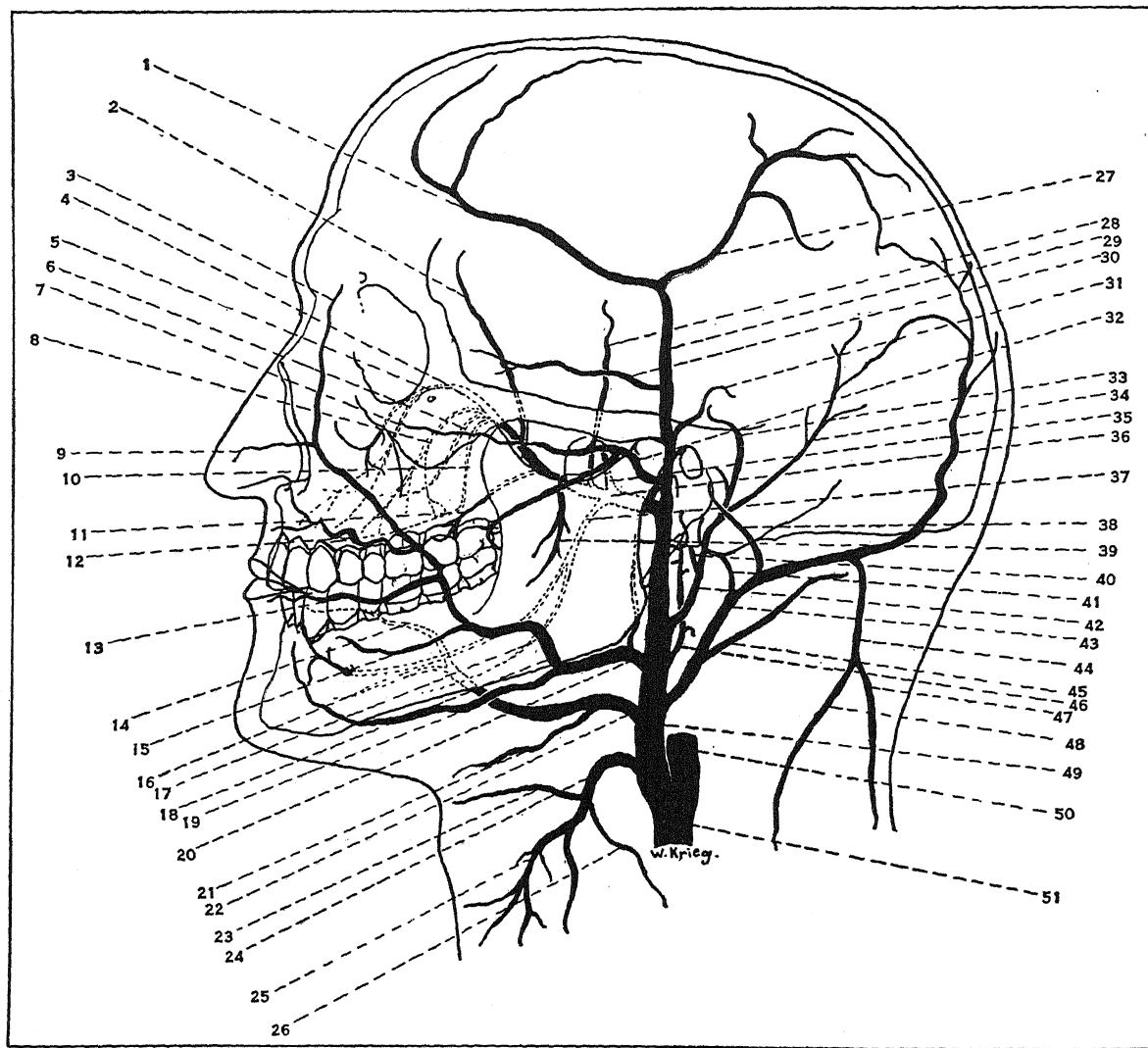


FIG. 3. ARTERIES OF THE HEAD

1, Frontal; 2, anterior deep temporal; 3, angular; 4, internal maxillary; 5, infraorbital; 6, sphenopalatine; 7, anterior superior alveolar; 8, posterior superior alveolar; 9, lateral nasal; 10, palatine; 11, buccinator; 12, superior labial; 13, inferior labial; 14, profunda linguae; 15, muscular; 16, sublingual; 17, external maxillary; 18, mylohyoid; 19, submental; 20, external maxillary; 21, hyoid; 22, lingual; 23, hyoid; 24, superior thyroid; 25, glandular; 26, sternomastoid; 27, parietal; 28, posterior deep temporal; 29, superficial temporal; 30, middle temporal; 31, anterior auricular; 32, transverse facial; 33, auricular; 34, occipital; 35, middle meningeal; 36, internal maxillary; 37, inferior alveolar; 39, masseteric; 40, stylomastoid; 41, meningeal; 42, posterior auricular; 43, occipital; 44, descending; 45, muscular; 46, ascending pharyngeal; 47, superficial branch; 48, deep branch; 49, external carotid; 50, internal carotid; 51, common carotid

ternal carotid artery enters the brain-case and gives off branches to the brain, and to the eye and its surrounding structures. The external carotid artery continues vertically outside the skull between the jaw and ear and distributes branches to the face and scalp. There are eight primary branches. These with their divisions are shown in Fig. 3. The first branch is the superior thyroid, which supplies the anterior and upper part

reaches the lower portion of the back of the skull, sending branches to the upper part of the back of the neck. The ascending pharyngeal goes to the back of the mouth; while the posterior auricular supplies the external ear. In front of the ear the carotid divides into two branches. Of these the larger, the internal maxillary, passes deep to the jaw and gives off many branches which supply the jaw muscles, nasal cavity

and teeth. The smaller division, the superficial temporal, continues upward to bifurcate at the side of the brain-case. Its branches supply the scalp and upper part of the side of the face.

The subclavian artery (Fig. 1) passes laterally in a broad curve behind the collar-bone. Though continuity is not interrupted when it reaches the armpit, it is here called the axillary, and on reaching the medial side of the arm it is termed the brachial. This vessel gradually attains to the front of the elbow, where it divides.

There are four branches from the subclavian. The first, the vertebral, ascends the neck through a hole in the side of each of the vertebrae of the neck, enters the skull, and is distributed to the lower part of the brain, connecting with the internal carotid, thereby ensuring efficient blood supply to the brain under all conditions. The second branch, the thyrocervical trunk, divides almost immediately into three. Of these, the inferior thyroid supplies the thyroid gland and the lower part of the front of the neck, the transverse cervical supplies the side of the neck, and the transverse scapular supplies the muscles over the shoulder-blade. The third branch is the internal mammary. It runs vertically downward close to the breast-bone and sends a pair of branches to the muscles in the spaces between each pair of ribs. The fourth branch, the costocervical trunk, supplies chiefly the deep region of the neck.

The axillary artery, continuous with the subclavian, is situated just medial to the shoulder-joint and humerus. It gives off six branches which supply the chest and shoulder. The brachial artery distributes branches to the arm, the chief of which is the profunda. The divisions of the brachial, the radial and ulnar arteries pass to the palm along the front of the forearm, lying on lateral and medial sides respectively. Branches are given off from these vessels to the muscles of the forearm. Some of these branches are arranged to form a network or anastomosis around the elbow and wrist. The largest branch in the forearm is the interosseus, which springs from the ulnar and divides into two branches which pass down between the bones of the forearm. The radial and ulnar each form a transverse arch on the palm, from which branches pass to each of the fingers.

Though the largest branches of the descending aorta are given off in the abdomen some small branches arise in the thorax. The heart is supplied by two coronary arteries which spring from the aorta at its junction with the heart. The bronchial arteries supply nourishment to the lungs. Each of the spaces between the ribs is supplied by twig from the aorta.

The contents of the abdomen are supplied by three great vessels. The highest is the celiac. It immediately divides into three vessels: left gastric, lienal, and hepatic. The first supplies the upper part of the stomach, the second supplies pancreas and spleen, and the third distributes to liver, lower part of stomach and duodenum. The small intestine and most of the large intestine are supplied by the middle and largest

of the three great branches to the abdomen, the superior mesenteric. It runs to the descending colon and rectum. The end branches of these intestinal arteries communicate freely, forming several arcades of loops. On either side a short thick vessel, the renal, runs laterally to the kidneys.

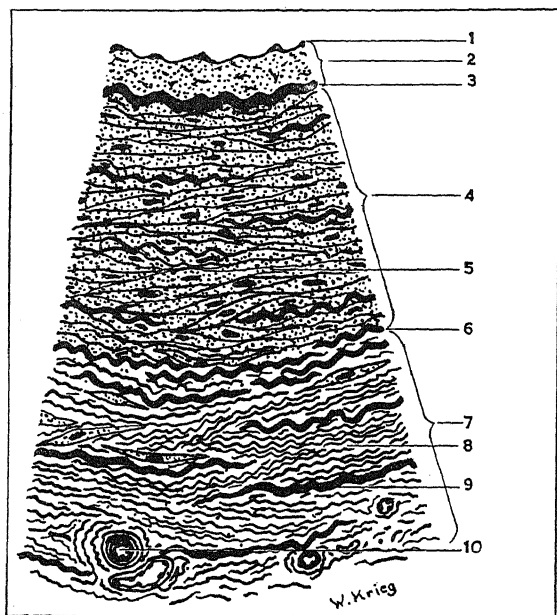
The vessels formed by the bifurcation of the aorta at the brim of the pelvis are the common iliacs. These divide in the pelvis into hypogastrics and external iliacs. The hypogastrics give off a number of branches to the genito-urinary organs, except the kidney, and to the pelvic wall and the buttocks. The external iliacs continue into the groin as the femoral artery of either leg. The largest branch of the femoral artery is the profunda. This distributes branches which furnish most of the blood of the thigh and continues downward just medial to the thigh-bone. The femoral artery gradually passes backward on the medial side of the leg until it lies behind the thigh-bone above the knee. Here it is designated as the popliteal. Branches are distributed from this vessel to the structures around the knee, and an anastomosis is formed around this joint. A few inches below the knee the popliteal artery divides into anterior tibial and posterior tibial arteries. The former courses down the leg just lateral to the shin-bone. At the foot it forms the dorsalis pedis and supplies branches to its upper surface. The latter artery passes behind the shin-bone, but gives off a large branch near its origin, the peroneal, which lies behind the fibula. The posterior tibial curves behind the medial side of the ankle into the foot. Here it forms a transverse arch similar to that in the palm, and a series of branches is given off in a like manner to the toes. W. J. S. K.

**ARTERIOSCLEROSIS**, or hardening of the arteries, is one of the most important degenerative processes that occur with advancing age. It is also an inflammatory process. As the result of the action of various injurious agents, the inner coat of the arteries may become inflamed (*see* ARTERY). Cells are killed and replaced by fibrous or scar tissue, bringing about a thickening of the blood vessel wall, loss of elasticity and narrowing of the opening through the blood vessel. Later, lime salts may be deposited in the arterial wall. In the same manner, but more gradually, death of cells and their replacement by fibrous or scar tissue occurs with old age. The rapidity with which this process takes place varies in different individuals.

Other causes of arteriosclerosis are infections, such as syphilis and tuberculosis; poisoning, especially by such agents as lead and alcohol; overeating and obesity; heart disease and kidney disease. In certain kinds of heart disease, the blood pressure becomes higher, which puts greater strain upon the arterial walls. In time this is harmful, and causes hardening of the arteries. As the result of kidney disease, toxic products that should be eliminated remain in the blood and produce arterial hardening. On the other hand, both heart and kidney disease may be produced by arteriosclerosis.

There is a condition known as essential hypertension in which there is high blood pressure with no discoverable cause for it. Such high blood pressure usually ends in the production of arteriosclerosis. See also PARALYSIS; THROMBOSIS AND EMBOLISM.

**ARTERY**, a tube carrying blood away from the heart to the capillaries. In ancient times the arteries were thought to contain air (whence their name), because when dissected, only after death, they were found empty of blood. When alive, the arteries contract on the blood; after death, however, blood clots, they relax and many are found empty. The arteries of the body may be divided into two systems, each of which forms a tree-like branching plan. The pulmonary system goes to the lungs, and the systemic



SEGMENT OF A CROSS SECTION OF A MEDIUM-SIZED ARTERY

1, Endothelial lining; 2, intima; 3, inner elastic membrane; 4, media; 5, smooth muscle; 6, outer elastic layer; 7, external layer; 8, white fibers; 9, elastic fibers; 10, blood vessels supplying artery

arteries supply all other parts of the body. (See VASCULAR SYSTEM: Arteries.) The main trunk of the systemic arteries is called the AORTA, which originates in the heart, and the smallest branches, nearest to the capillaries, are the arterioles.

The circulatory system contains as its fundamental part a continuous, delicate inner tube, the endothelial tube. When alive, it prevents the blood from clotting. This is covered in arteries by outer coats. Next to the endothelium is a layer of elastic fibers, the two together making the "intima." Outside this is the coat of smooth muscle fibers ("media"); while outside of this again are the white connective tissue fibers and the elastic fibers ("externa"). The smooth muscle fibers, which surround the intima, like a sleeve, regulate the size of the artery, and thus the amount of blood supplied to the structures served by it. The elastic fibers maintain an equable pressure,

and the white fibers give the artery strength and prevent overdistension.

The pressure decreases steadily from aorta to capillaries; so does the amount of elastic tissue. This furnishes recoil for the pump-like action of the heart, smoothing out the pulse wave, until in the capillaries the flow is practically even in pressure.

Corresponding with the reduction of elastic tissue in smaller arteries as pressure is lessened, there is an increase in proportion of smooth muscle fibers. These are gathered in the middle portion of the artery (4 in figure), while the elastic fibers, though partially mixed with the muscle fibers, are concentrated in two membranes: internal and external to the muscle layer (6 in figure). The muscle fibers are abundantly supplied with sympathetic nerves and through them the caliber of the artery is constantly changing, being adapted to the degree of activity, at the moment, of the structures the artery supplies.

The white fibers form the most external of the three coats of an artery (7), and blend with the connective tissue through which the artery runs. In the limbs the arteries lie in the best protected positions. Wounds in them would endanger life.

B. C. H. H.

**ARTESIAN WELLS**, a term applied to wells sunk into water contained under a buried layer of rock or compacted gravel in such circumstances that it is under pressure and will rise in the bore when the impervious layer is tapped. The term artesian well is sometimes incorrectly used to designate any deep well, and by some is used only when referring to wells which overflow at the surface. Strictly, an artesian well is one in which the water rises above its point of ingress. If the water rises above the surface, or even above the WATER TABLE so that it flows into the surrounding soil, it is a "flowing well."

If a porous rock, or sand or gravel formation, comes to the surface, or "outcrops" in a region where the precipitation is not too light, water will gather in and travel through the pores between the grains, the joint cracks, bedding planes, and various cavities, more or less saturating the rock, which is then known as an "aquifer." If this formation slopes, or dips down, and is covered and underlain by other beds impervious to water, the contained water will act practically as though it were confined in a tilted pipe. Consequently, in the lower portions it will be under pressure, due to the higher elevation of the "catchment basin," or point of inflow.

Artesian wells often contribute to the water supply of communities, especially in the Atlantic coastal plain, the high plains east of the Rocky Mountains, and the upper Mississippi Valley. In arid areas they are of local importance in irrigation. Many parts of Australia depend on artesian water for their supply. See also WATER; WATER, UNDERGROUND. S. F. K.

**ARTFUL DODGER, THE**, the nickname given the character John Dawkins in Dickens's *Oliver Twist* because of his light fingered thieving. The name is sometimes applied to likeable persons of shifty habits.



**ARTHRITIS.** With the exception of "colds" and diseases of the heart and blood vessels, arthritis (or chronic rheumatism) constitutes the most widespread, the most disabling and the most economically costly disease which affects society. It occurs in nearly all climates and affects chiefly persons in mid-life, though frequently young people and children also. It is the oldest disease of which we have any record and occurred among the giant reptiles of the Mesozoic Era long before the advent of man. The disease assumes two main types, *atrophic* and *hypertrophic*, but there are certain forms which cannot be easily grouped under either.

**Atrophic Arthritis.** This affects mostly young adults and persons under middle age, although it also occurs among the elderly and in children. It is characterized by an overgrowth of the synovial or lining membrane of the joint and by an upward growth of the marrow tissues at the ends of the bones, which, together, tend to destroy the cartilage, lead to fibrous adhesions between the joint surfaces and finally to actual bony union or ankylosis. The symptoms are stiffness, pain or swelling in the fingers or other joints and frequently fatigue and headache. Sooner or later the knees, shoulders or hips become involved. Locomotion becomes difficult and without adequate supervision the patient may be reduced to a wheel-chair invalid. Exceptionally, motion may remain in only a few joints of the body. Anemia is common.

The cause of atrophic arthritis is not completely understood, but recent study has revealed that there are hereditary, constitutional and premonitory factors, as well as agencies within the body, which may underlie or cause it. Foci of infection may be precipitating factors and, in early cases, removal may be followed by arrest of the disease. A significant advance in our knowledge consists in recognition of the rôle played by the intestinal tract and the food intake which may act much as focal infections do.

Treatment of atrophic arthritis is complicated, but under the best conditions of modern practice is followed by a high percentage of success. Arthritics usually need enforced rest, local treatment to joints in the form of carefully applied heat and massage, attention to or removal of focal infection, correction of faulty intestinal function when present, the institution of a proper dietary, correction of faulty body posture or joint deformities and medication along the lines indicated in a given case. The error of avoiding red meat and such vitamin-containing foods as fruits, tomatoes and the like, has long been a source of aggravation of the disease process. A large intake of starches and sweets often conduces to arthritis and is more harmful than are meats, although these should be kept within reasonable limits. The diet best adapted to arthritis is usually a somewhat restricted one, rather low in carbohydrates, higher in fats and accompanied by adequate protein and ample vitamins in the form of fruits and vegetables. Great care must be exercised that such a diet be not applied to cases already undernourished, febrile or otherwise open to

danger from undernutrition. Sometimes irrigation of the bowel is helpful, especially where there is marked stasis, but it should be remembered that the substances thus removed are in large part those introduced by mouth. In addition to the removal of focal infection, vaccines are sometimes of value, but many abuses have occurred and the indications for them should be clear. Injections of other substances such as typhoid organisms of milk are sometimes beneficial because of the reaction which they induce. Conduction of a program as elaborate as the above requires careful medical oversight.

**Hypertrophic Arthritis.** This is a disease of the middle and later decades of life. It is characterized by degenerative changes of the cartilage of the joints, accompanied sooner or later by overgrowth of bone at various places, especially the margins of the joints. This is conspicuously seen at the ends of the fingers. The disease is often not so crippling as is atrophic arthritis, but equal disability may arise and the most grotesque bony deformities encountered are due to it. Complete bony union or ankylosis rarely results, however.

Heredity, the body makeup, possibly the menopause in women, probably infections of various kinds and certainly the intestinal tract and food intake play an important part in precipitating the disease. The subjects of it usually require rest and this can be given to the joints more freely than in atrophic arthritis because of the lesser danger of ankylosis. The influence of infection should be considered, though operative removal is often contraindicated because of age. Heat and massage play a useful rôle in alleviating pain and in achieving betterment of position and function of joints. The general health of these cases is usually better than in atrophic arthritis, but the greater age of the subjects often introduces complications from this source. Attention to the food intake and to intestinal elimination is of the highest importance and may prove to be the determining factor of convalescence.

In both types of arthritis the urgent indications are for correct diagnosis, early prevention or treatment of deformity and a well-balanced program in which the many possible etiologic, contributory and therapeutic factors are considered. There must be close and sustained coöperation between patient and physician.

R. PE.

**ARTHRITIS, GONORRHEAL.** See GONORRHEA.

**ARTHUR, CHESTER ALAN** (1830-86), 21st President of the United States, was born at Fairfield, Franklin Co., Vt., Oct. 5, 1830. After graduating from Union College, he was appointed principal of a school at North Pownal, Vt., and in 1853 gave up teaching to study law. After one year's study in the office of a New York attorney, he was admitted to the bar. He soon revealed his stand on the slavery controversy by appearing as counsel for fugitive negroes. His championship of negro rights gained him increasing importance in the Republican party, and

his political life began with the outbreak of the Civil War. In 1861 Gov. Edwin D. Morgan of New York appointed him successively engineer-in-chief, inspector-general, and quartermaster-general. He retired to private practice in 1863, but eight years later was appointed by President ULYSSES S. GRANT to the office of collector of the Port of New York. While collector, Arthur was involved in charges against the Customs House made by a commission appointed by President RUTHERFORD B. HAYES. The latter determined to modify the "spoils system," to which Arthur subscribed as a practical politician. Senator Roscoe Conkling, state Republican leader, defended the patronage appointments in the Customs House, which was heavily overstaffed, but the President succeeded in suspending Arthur in July, 1878, the Tenure of Office Act preventing dismissal. In the next session Congress unexpectedly supported Hayes' move, and Arthur, a political martyr in many eyes, lost his post. But he was soon compensated. To placate the Grant followers who failed to win renomination for the General in 1880, Arthur was made Republican nominee for Vice-President, on the ticket with JAMES A. GARFIELD, and was elected. He assumed his duties in Mar., 1881, and immediately sided with Conkling when the New York patronage controversy was resumed. Garfield insisted on his right to make such appointments as he saw fit. During the ensuing contest, Garfield was assassinated by an office-seeker, and on Sept. 19, 1881, Arthur took the presidential oath of office.

The President surprised his former political associates by urging reforms in the civil service and by failing to make appointments for political reasons only, signing and scrupulously enforcing the Civil Service Reform Act (1883). He supported the Tariff Act of 1883, a downward revision necessitated by an enormous surplus, concerned himself with the building of the Atchison, Topeka and Santa Fé, Northern Pacific and South Pacific Railroads and had various taxes repealed. Arthur was defeated for renomination by James G. Blaine, at the Republican National Convention of 1884, and soon after retired to New York. He died in New York, Nov. 18, 1886.

See G. W. Smalley, *Life of Chester Alan Arthur*, 1880.

**ARTHUR, TIMOTHY SHAY** (1809-1885), American author, was born in 1809 near Newburgh, N.Y. Among his many stories, some of which were dramatized, the most noted are *Ten Nights in a Bar Room*, *Tales for Rich and Poor* and *Lights and Shadows*. Arthur died in Philadelphia, Pa., Mar. 6, 1885.

**ARTHURIAN LEGENDS**, a great body of legends inspired by the noble character and deeds of Arthur, a semi-mythical king of the Britons in the 6th century. Historically, Arthur was probably a Roman-Saxon leader of the armies of south Britain; a Christian, he fought against the invading Saxons, one of his most notable battles being that of Mt. Badon (c. 515); it is possible that he was betrayed by Guenevere, his wife, and a trusted friend or kinsman,

Lancelot; he is supposed to have been buried at Glastonbury. Of this military hero time and the fancy of poets created the central figure of a romantic cycle of legends.

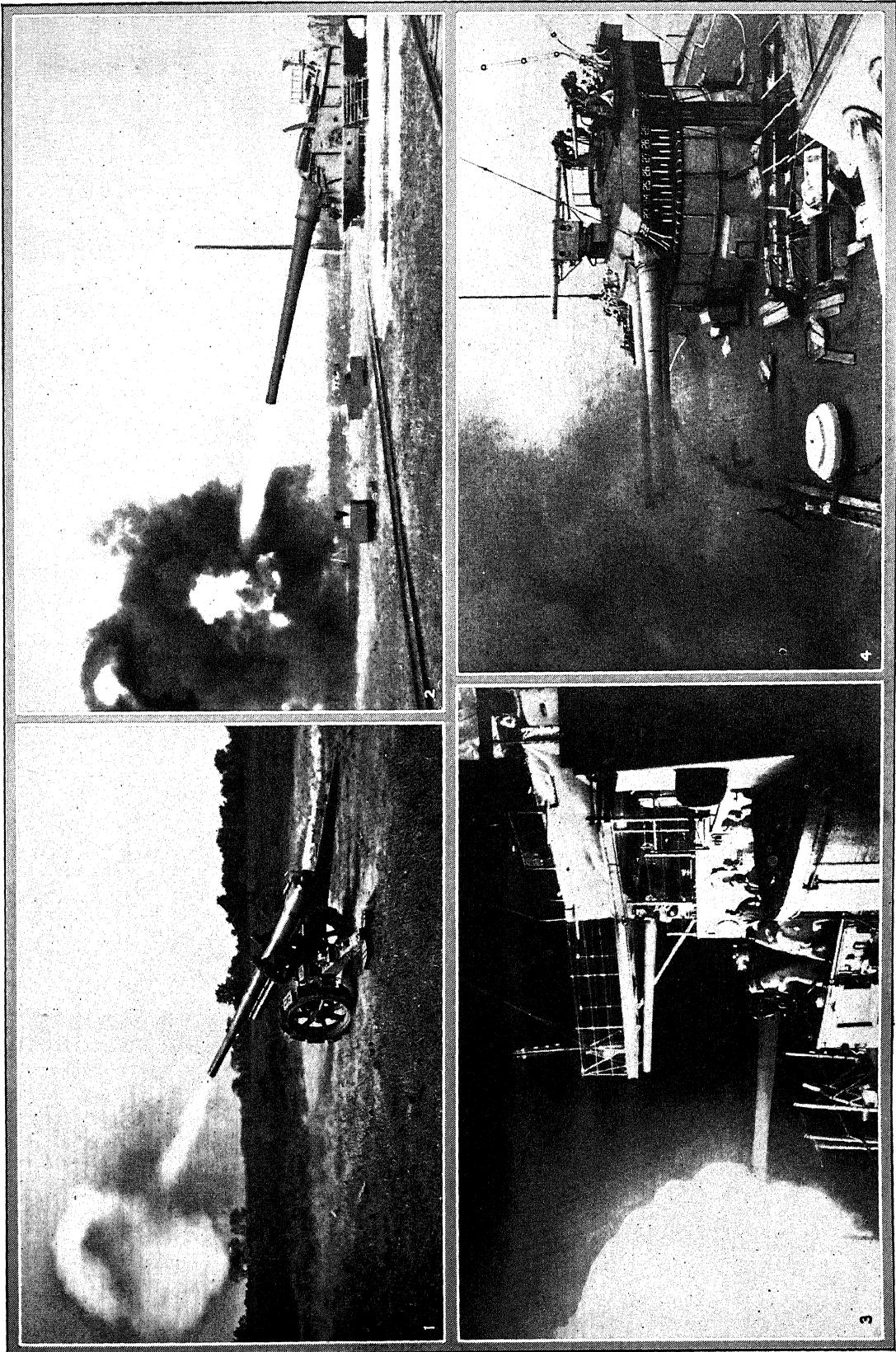
The earliest historical account of Arthur is that given by the Welsh Nennius (fl. 795), whose sources of information are unknown. William of Malmesbury treated of the king more elaborately in his *Gesta Regum*, completed about 1120, by which time the story of Arthur was well-developed. The hero next appears in Geoffrey of Monmouth's *Historia Britonum*, written about 1147. Between 1150 and 1200 the legend grew apace. Most important in England were Robert Wace's *Roman du Brut*, a Norman French rendering in verse of the *Historia Britonum*, composed before 1175, and Layamon's *Brut*, a paraphrase in Early English verse of Wace's poem, finished before 1200. In the same period, 1150-1200, the legend, or *Matière de Bretagne* as it was called, was greatly expanded by French and German poets. In French verse the outstanding achievements were the versions of Chrétien de Troye. These works were the basis of the German poems *Erec* and *Iwein* by Hartmann von Aue. More important, however, in German was the *Parzifal* of Wolfram von Eschenbach, which later became the source of Wagner's opera, *Parsifal*. In French prose the most influential rendering of the legend was that by Robert de Borron, whose Arthurian trilogy was divided into the parts *Joseph of Arimathaea*, *Merlin* and *Perceval*. The legend, encumbered with additions and interpretations, had reached a state of decadence when SIR THOMAS MALORY in the 15th century made of it the English epic, *MORTE D'ARTHUR*. Among 19th century versions of the legend the two most notable in English were William Morris's *Defence of Guenevere*, published in 1858, and Tennyson's *IDYLLS OF THE KING*. See also *GALAHAD*; *GRAIL*; *ROMANCE*; *ROUND TABLE*.

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**ARTICHOKE** (*Cynara Scolymus*), called also globe artichoke, a perennial plant of the composite family native to Mediterranean countries and widely cultivated as a vegetable. It is prized for its large thistlelike flower-head, of which the fleshy receptacle and the thickened basal portions of the surrounding floral leaves are edible. It is cooked in various ways, but chiefly boiled and served hot with mayonnaise or butter. Artichokes are cultivated commercially from sprouts or suckers, growing best in rich, well-drained soils in foggy climates with neither too much heat nor cold. In the United States their commercial production is practically limited to small areas in California. See also **ARTICHOKE, JERUSALEM**.

**ARTICHOKE, JERUSALEM**, called also girasole, the edible tuber of a tall, coarse sunflower (*Helianthus tuberosus*), native to eastern North America, formerly used for food by the Hurons and other Indians. While grown in the United States and in

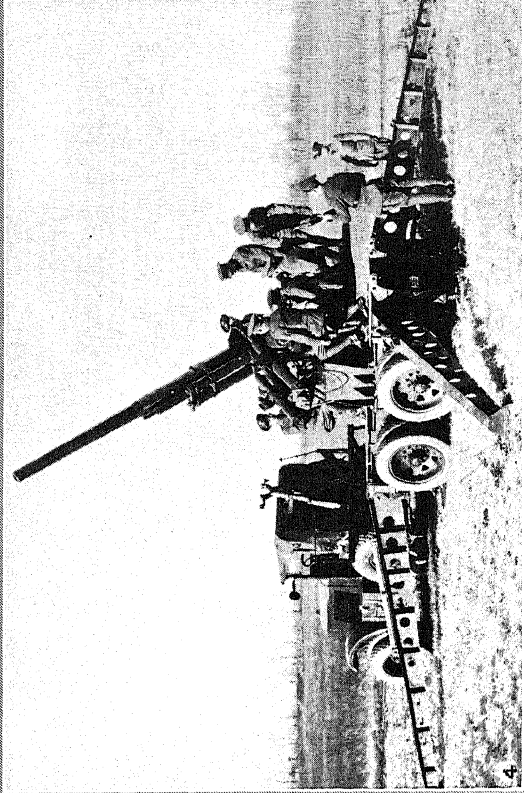
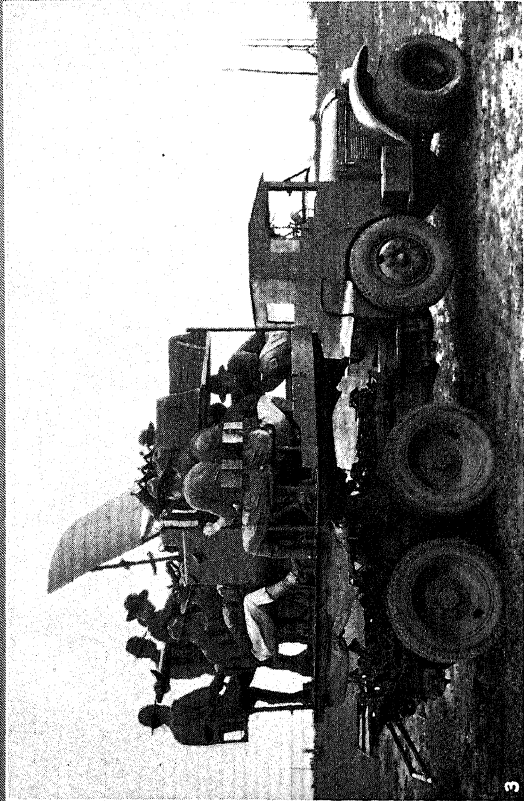
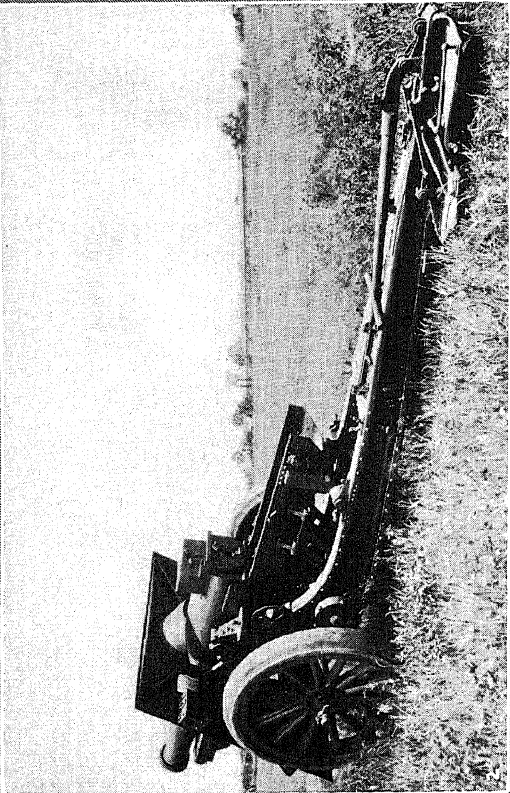
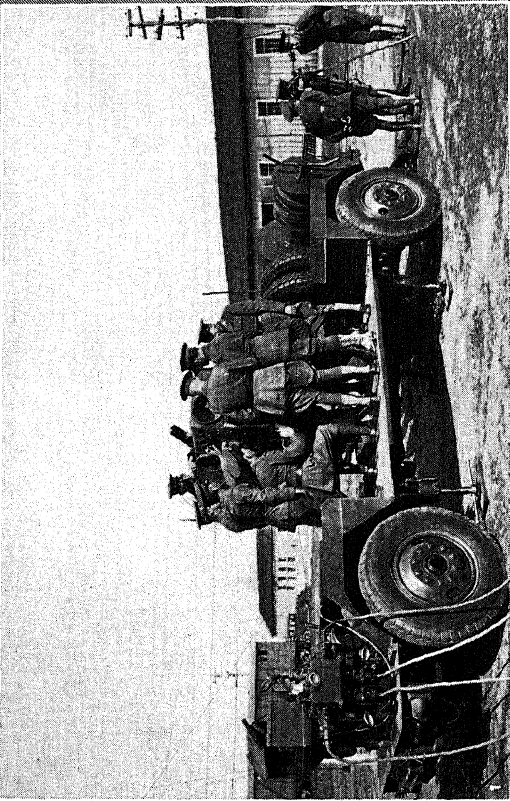
# ARTILLERY



## ARMY AND NAVY ARTILLERY

1. 4.7-in. gun in field service. 2. 16-in. gun on barbettes mount. This gun throws a projectile of 2,100 lbs.
3. Naval night practice with a 5-in. broadside gun. 4. 12-in battleship guns.

# ARTILLERY



## ARMY ARTILLERY AND INSTRUMENTS

1. Instrument trailer with Sperry director. Anti-aircraft spotting instrument at right.
2. 155-mm. howitzer in field service.
3. Anti-aircraft multiple machine gun with truck mount.
4. 3-in. anti-aircraft gun on truck mount.



France, chiefly as a stock food, it is gaining repute as a culinary and salad vegetable. It stores carbohydrates in the form of inulin, making it a suitable food for diabetic patients. The tubers also contain levulose, a more effective sweetening for foods than ordinary sugar. As the plant is more productive and easier to cultivate than the potato, it possesses great possibilities for commercial development.

**ARTICLES FOR THE GOVERNMENT OF THE NAVY OF THE UNITED STATES**, a body of laws taken from the statutes and certain amendatory statutes covering a period of years. It is customary for an abridged form of the Articles to be read out at general muster on board of naval vessels the first Sunday in each month, and at such stations as may be necessary. These articles relate to conduct and morals in general; offenses punishable by death; offenses punishable at discretion of court martial; those punishable by fine and imprisonment; those with punishment unspecified; prize regulations; summary court martial procedure; general court martial procedure; courts of inquiry; deck courts; and miscellaneous provisions. These articles are the main guidance of persons in the naval establishment, and are posted in conspicuous places on board all vessels and at Navy Yards and stations. R. E. C.

**ARTICLES OF ASSOCIATION**, an instrument similar to a certificate of incorporation but usually applied to non-stock corporations such as social, charitable and mutual benefit organizations. Such an instrument also usually is executed as the first official step in the organization of banking institutions. The comptroller of the currency furnishes the form for national banks which requires a recital of facts concerning the proposed bank such as title, location, capital stock, number of directors, date of annual meeting, powers of directors and other information.

**ARTICLES OF WAR**, a code for the government, at all times and in all places, of the armies of the United States, including the militia in Federal service, prescribed by Congress in the exercise of its constitutional power to make rules for the government and regulation of the land forces and for governing such part of the militia as may be employed in the service of the United States. By enactment, reenactment and revision, this body of Federal law, which is supplementary to the ordinary law of the land, has come down from the period of the Revolution.

**ARTIFICIAL DAYLIGHT**. See DAYLIGHT, ARTIFICIAL.

**ARTIFICIAL DEFORMATION**. See DEFORMATION, ARTIFICIAL.

**ARTIFICIAL RESPIRATION**. See RESPIRATION, ARTIFICIAL.

**ARTIFICIAL SILK**. See YARNS, SYNTHETIC.

**ARTIGAS, JOSÉ** (c. 1760-1851), Uruguayan patriot and soldier, born at Montevideo. In 1811, after the inauguration of the revolutionary movement in Buenos Aires he rose against the Spanish authorities, and with Colonel Rondeau, whom Argentina sent to his aid, he conquered the royalists, obliging them to

retire to Montevideo. The armistice of Oct. 20, 1811, raised the siege of the city, and Artigas withdrew across the river; but when the siege was renewed a year later he was given command of an important position in the lines. In Jan. 1814, six months before the city capitulated, he broke completely with his allies over the question of national organization, in 1815 forced them to withdraw from the province, and was for a time the leader of the federalist opposition to political concentration in Buenos Aires. In 1816 Brazil invaded Uruguay, and Artigas manifested great military genius in his defense, but was defeated in the decisive battle of Paso del Calatan Jan. 4, 1817. He retired first to Entrerrios, then to Paraguay (1820), where he died.

**ARTILLERY**, all missile weapons too heavy to be carried by men and those troops assigned to the service of such material. Exceptions to this statement exist as the boundary line is not sharp.

**Army Artillery**. Before the introduction of gunpowder, artillery was little used in the field. Depending upon mechanical means of projection, its material was either too cumbersome or too low in power. Its principal use was in sieges. Gunpowder artillery appeared in Europe in the 15th century. The new propelling agent gave a much more favorable weight ratio between gun and projectile, and mobile guns soon took their place in field armies. Artillery still remained a semi-military service, handled by hired laborers directed by a few skilled men; its military character increased as its material improved, but it was not until the 19th century that it became a true fighting arm, coordinate with INFANTRY and CAVALRY. With short range and low mobility of the guns, artillery tactics were rudimentary. Artillery committed to action could do little but fire straight to the front until the enemy was repulsed or the guns taken. The general scheme of a battle included an artillery duel, after which the superior artillery proceeded to prepare and support an infantry attack.

During the latter part of the 19th century mechanical means for controlling recoil became highly developed for artillery of position, but weight and complication prohibited their use in the field gun, which still recoiled bodily on the ground. In 1897, was introduced the French 75-mm rapid fire field gun, recoiling on its carriage and returning automatically to firing position. The great advantage of this class of gun is not the rapidity of fire from which it takes its popular name, but the flexibility of fire. The stability of the carriage led to the adoption of accurate laying devices, and to the habitual use of indirect fire—i.e., laying upon an auxiliary point after setting off the proper deflection on the sight. This, together with the increasing range, made it possible to use concealed positions and to shift fire readily from target to target.

It had long been recognized that the proper target of artillery is that element of the enemy that is, for the moment, most dangerous to the friendly infantry. The trouble had been that, with open positions, it

had been almost impossible to adhere to the rule. When a battery came into action some hostile battery at once took it under fire. It was compelled, in self-defense, to reply, and an artillery duel ultimately resulted, leaving the infantry unsupported. With the new flexibility, specialization of tasks became easier. Certain batteries, in concealed positions, could fire in direct support of the infantry. Hostile reply was slower and less accurate than in the days of open positions; and it was now possible to place counter-batteries in observation, ready to take under fire any hostile guns that might interfere with infantry batteries. The fire became more effective, too, as positions and types of guns could be selected in view of the tasks to be given them.

The Division is usually the smallest force possessing its own artillery. This is chiefly light, of about 3-in. caliber, but often some medium batteries are included, running as high as 6-in. caliber. The smaller pieces are usually GUNS in the technical sense, with flat trajectory; the larger HOWITZERS, designed for higher angles of elevation. Cavalry divisions have light guns only; for greater mobility, they are equipped as horse artillery, the cannoneers riding individual mounts instead of the carriages. Most of the divisional artillery works in direct connection with the infantry. Specific batteries may be placed temporarily under the actual orders of specific infantry commanders and are then said to be attached to the infantry units; more usually, however, they are designated merely as supporting artillery, remaining under the higher artillery commanders. The difference is in degree of control only; in either case the artillery and infantry commanders working together remain in constant communication, and the duty of the artilleryman is to give the infantryman such help as he requires.

Pack artillery is designed for use in country where wheels cannot go.

Counter-battery fire and fire on strong works, are handled normally by the corps artillery. This includes howitzers similar to the heavier ones of the divisions, and flat trajectory guns of about 6-in. caliber.

Army artillery includes pieces of many types. There are light guns equipped for transport by motor truck ("portee artillery"), pack guns and long range pieces, up to 14-in. guns mounted on railway trucks. Army guns are usually assigned temporarily to corps or divisions to reinforce their own artillery for specific operations; hence their mountings are designed for rapidity in long distance moves even at the expense of convenience in local cross-country work.

To the higher troop units there are assigned special guns for fire upon aircraft. Experiments are in progress with a view to developing a type of gun for fire on both ground and air targets.

Mechanical transport has facilitated the use of heavy guns for seacoast and siege artillery. *See also* COAST DEFENSE; ANTI-AIRCRAFT GUNS; ORDNANCE. O. L. S.

**Naval Artillery.** Major caliber naval guns of 12" to 16" caliber comprising the main batteries of

capital ships weigh frequently in excess of 100 tons apiece and are invariably mounted in turrets and fitted with special power-operated gear to permit quick loading and pointing. They are built up from a series of long concentric forgings or hoops shrunk on successively so as to put the tube in a state of initial compression and so enable it better to withstand the heavy internal pressures of firing. In foreign services wire winding is sometimes used for strengthening the gun tubes. The newest method, however, is that of autofrettage or radial expansion. With this the gun barrel is not built up in layers but is a single block which before finishing has been subjected to internal hydraulic pressure in excess of what it will experience during firing. This newer method, though not yet applied to the largest calibers, has such great advantages in reducing weight and increasing safety, that it is gradually replacing all other methods of gun construction.

The breech of the gun is closed by a cylindrical breech plug which is swung by a hinged carrier to fit into the screw box. When swung into place, the plug is rotated a fraction of a turn so that the teeth on its periphery engage in the teeth of the screw box, so closing the breech of the gun securely during the firing. To prevent all gas leakage, the construction provides a canvas-covered, gas-check pad containing tallow and asbestos held in place on the forward face of the breech plug by a mushroom whose stem extends completely through the axis of the plug. Pressure on the mushroom squeezes the gas-check pad so as to make it expand radially during the firing, and thus completely seal the breech against gas pressures of nearly 20 tons per sq. in. By pneumatic power, the breech mechanism of a turret gun can be operated in a fraction of a second. The bore of the gun has spiral grooves into which the slightly larger copper rotating band on the projectile is forced, so that in travelling down the bore, the projectile receives the spin needed to make its flight stable.

In the rear of the rifled part of the bore and forward of the breech plug, the inside of the gun is somewhat enlarged in diameter to form the powder chamber for the charge which is placed behind the projectile. In the largest guns this charge is composed of four or five cylindrical silk bags tightly packed with smokeless powder. The rear end of each bag carries an ignition charge of black powder. On the rear of the breech plug is a firing lock containing a small primer about the size of a small arms cartridge. An electric current passing through a high-resistance bridge in the primer fires it and causes the primer gases to pass into the powder chamber through a small hole in the axis of the mushroom. This ignites the ignition charge on the rear powder bag and practically instantly starts the burning of the smokeless powder charge and fires the gun.

Projectiles generally are brought up into the turret chamber in rear of the guns through tubular hoists, while the powder, either in cars or hoists, comes up separately. Elaborate systems of flame-tight doors



protect the MAGAZINES from fires in turrets. After a gun is fired in the elevated position, it is rapidly brought to a nearly level loading position. The breech is opened as soon as possible and the inflammable gases are blown out through the muzzle of the gun by the action of high-pressure air introduced through oblique holes in the screw box. A spanning tray is swung so as to enter the breech and on it the projectile, previously ready for the load, is rammed in by a power-operated rammer till it seats in the beginning of the rifling. The powder next is run in by another operation of the rammer, the loading tray removed, the breech closed and the gun with a fresh primer in its firing lock, is rapidly elevated to position for firing the next round. On discharge, the gun recoils several feet in its slide, being gradually checked by the action of a large hydraulic recoil system. It then is automatically run forward to its original position by the air pressure or the springs of the counter recoil system. In the U.S. Navy there are either two or three guns in each turret and the elevating gear which brings them to the desired angle of elevation, works all guns simultaneously. The whole turret structure, by the action of the training motor rotates to bring the guns on the target in azimuth.

Pointers and trainers thus subdivide the work so that the trainer rotates the turret till the vertical line in his telescope is on the target, while the pointer elevates the guns till the horizontal line in the pointer's telescope, which is elevated according to the range, is on the target also. In director firing, however, the same thing is accomplished by the use of electric indicators operated from elevated stations which show the pointer and trainer when the guns are on the target. Turret machinery is operated by special variable speed gears of the electric-hydraulic type. Broad-side guns of 5" caliber and antiaircraft guns are generally without shields and are trained and elevated by hand. Some types use powder bags like turret guns while others use brass cartridge cases. In general, naval ordnance differs from that used ashore by having a much larger percentage of heavier guns of unusually high velocity, and by having machinery capable of maneuvering them faster, because of the motion of the ship. Firing erodes such guns rather rapidly, however, so that after a few hundred rounds, turret guns must be relined. The 8" turrets of cruisers, while smaller than those of capital ships, are of practically similar design; but 6" cruiser turrets are fitted up much less elaborately. *See also GUNNERY.*

G. L. S.

**ARTILLERY PLANT** (*Pilea microphylla*), a small attractive plant of the nettle family, native to southern Florida and tropical America. It is cultivated in greenhouses for its graceful foliage composed of fine shining leaves. When the mature staminate flowers are placed in bright sunlight they open explosively with an artillery-like discharge of pollen.

**ARTIST**, one who creates and executes a production of esthetic quality through the application of taste, imagination, knowledge and skill. The ele-

ment of original creation distinguishes the artist from the artisan. The quality of original perception and interpretation in addition to superior technical execution, constitutes his talent or genius. Composers, architects and dramatists are primarily creators; actors, conductors, or musicians distinguished in the playing of some particular instrument or instruments, are primarily interpreters; sculptors, painters, poets, writers and dancers are both creators and executors. The expression of beauty or of a truth, but fundamentally the need for self-expression, is the impetus behind the artist's efforts. Commercial artists use their skill to interpret sales ideas, as in advertising illustration. This commercial field offers to the artist the financial advantages of a business career.

**ARTS AND CRAFTS**, an inclusive title for the decorative arts and for such artistic crafts as book-binding, jewelry-making, weaving, pottery and the like. The name was first given to the movement inaugurated in 1875 in England, the object of which was to achieve greater emphasis for the decorative as opposed to the pictorial arts, and to develop and encourage all the arts and crafts which had to do with the use and beauty of the modern home. In its inception the movement was wholly antagonistic to machine production. In the 20th century, however, the arts and crafts movement generally may be seen to have widened its scope; and the best summary of its later aim and accomplishment is perhaps to be found in the slogan of the Exposition of Swedish Decorative Arts held in Stockholm in 1930: "More beautiful things for everyday use." This includes all arts and crafts which serve everyday usefulness, as well as those which wait upon architecture; and it does not disdain cooperation with the work of the machine at its best, although handwork still remains the most important feature of arts and crafts movements.

The history of the development of the decorative arts and the allied crafts in this modern movement may be dated definitely from the days of WILLIAM MORRIS and the Pre-Raphaelites in England. These artists sought to bring about in their fellow countrymen a rebirth of interest in handwork, which machine production had practically killed in England and America, and also a finer and simpler taste in furniture, house decoration and, generally, the things of every day. Their success was considerable. The pronouncement, "I will have nothing in my house which I do not know to be useful or believe to be beautiful," did become surprisingly general as a household creed. When in 1886 a number of English artists revolted against the Royal Academy's emphasis upon the art of painting at the expense of the arts of architecture, sculpture and decoration, there was a soil ready for the seed of the arts and crafts movement. In the Arts and Crafts Exhibition Society the seed quickly germinated.

The arts and crafts movement may, however, be truly called international. In the United States the improvement of public taste and the revival of inter-

est in handwork and the decorative arts followed a course somewhat similar to these movements in England. On the continent of Europe, where the handicraftsman had never seen his work swallowed up, nor felt his craftsman's pride and interest killed by the onrush of the machine, the crafts and decorative arts have nevertheless been subject to accentuated development in the years since the end of the 19th century. The Exposition of Decorative Arts held in Paris in 1925 marked a milestone of the greatest importance, both in the cooperation of machine and handwork and in the renascent interest in beauty in everyday things. In the years 1928, 1929 and 1930 the American Federation of Arts, with the assistance of the General Education Board, arranged valuable international exhibitions in the United States. Other indications of the spread of the arts and crafts movement may be seen in the success of the Swedish societies organized for the furtherance of home crafts, and in the establishment of craftsmen's societies in many American cities. New York, Boston and Detroit may be mentioned as possessing representative organizations of this kind.

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**ARTSYBASHEV, MIKHAIL PETROVITCH** (1878-1927), Russian novelist, was born in South Russia, Oct. 18, 1878. His stories and novels were very popular in Russia while he was living and reflected the revolutionary tendencies of the times. Among his important works are *Sanine*, *The Breaking Point* and *Jealousy*. Artsybashev died at Warsaw, Mar. 3, 1927.

**ARUMS.** A large family of plants, chiefly tropical, containing many showy and some grotesque species, with a few which yield important food products. Some 1,500 species, belonging to 100 genera, are known. Arums, called also aroids, are widely cultivated as foliage-plants, or for their peculiar flowering, exemplified in the Calla-lily (*Zantedeschia æthiopica*). The so-called flower consists of a colored bract, or spathe, sheathing a clublike spadix on which are clustered the true florets, often imperfect. Of the few North American arums, the most familiar are jack-in-the-pulpit (*Arisæma triphyllum*) and skunk cabbage (*Symplocarpus foetidus*). A single species, western skunk cabbage (*Lysichiton kamtschatscenses*), grows on the Pacific coast.

The starchy tuberous roots of certain aroids become edible when an acrid principle they contain is removed by cooking. Taro tubers, and *poi*, a fermented paste made from them, form staple foods with Hawaiian natives, who use also taro leaves and shoots as greens. Under the name dasheen, taro (*Colocasia esculenta*) has been grown as a vegetable in the southern United States since 1913. Species of *Xanthosoma*, called yautia, or malanga, native to the American tropics, are cultivated like taro. The British cuckoo-pint (*Arum maculatum*) yields an edible starch called Portland sago, or British arrow-root.

**ARUNDEL**, a municipal borough of Sussex, England, lying on a slope above the river Arun, and overlooking a gap in the South Downs, 58 mi. southwest of London. The famous castle, commanding the river from above, was built in Norman times by Roger de Montgomerie on an ancient site, and after frequent damaging by wars was finally restored in the early 19th century. Pop. 1921, 2,742; 1931, 2,489.

**AS**, an old Roman unit of weight, measure and money. The as of weight contained about 12 oz.; in measure it was about a foot; in money, a one-pound bronze coin. The name was given to coins which at various times varied in weight from one pound to half an ounce.

**ASA**, third king of Judah after the secession of Israel. He reigned 40 years, from 933 B.C. onward; the chronology is not precisely determined. He "did that which was good," and in his zeal against idolatry dethroned his mother, Maachah, took her idol, and burned it at the Brook Kedron. He restored the Temple, fortified the country and inflicted defeat on Zerah the Ethiopian with a large invading host. But confronted by Baasha, King of Israel, Asa offended the prophet Hanani by purchasing the help of Benhadad, King of Damascus, who attacked the Israelite state. "Diseased in his feet," Asa died, apparently of gout.

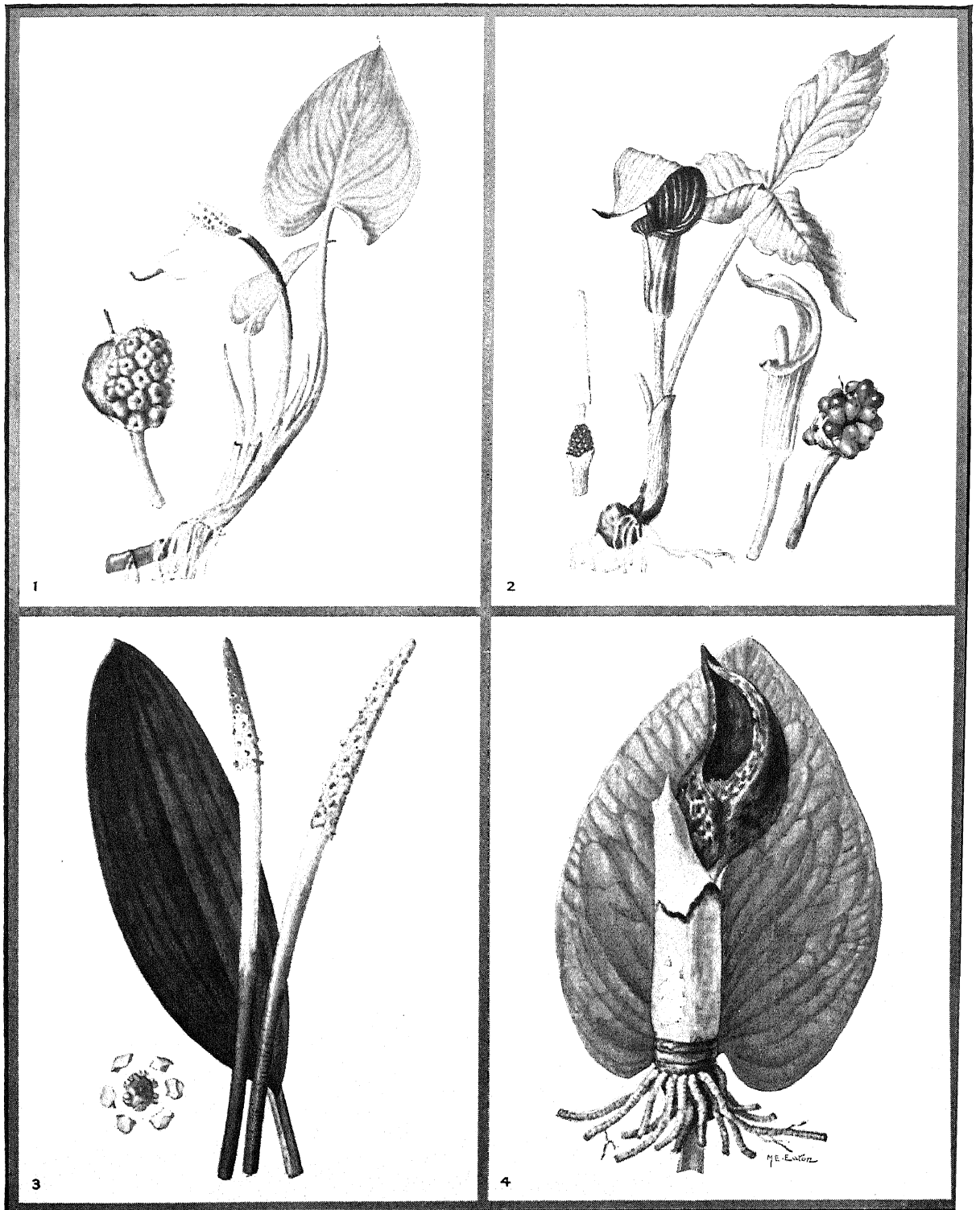
**ASAFETIDA**, a gum resin obtained by incising the living rhizomes and roots of *Ferula Asafoetida*, and of other species of *Ferula*. It has a persistent garlic-like odor and a bitter taste. In medicine its limited use is to the treatment of hysteria.

**ASAHIGAWA**, a town near the center of Hokkaido, the northern island of Japan, and home of the Ainu, or aborigines of the country. About two decades ago the environs of the town were a wilderness. The lines of the Imperial Japanese Government railways passed through Asahigawa and with the development of the island into a fishing and foreign trade section, the number of inhabitants increased. Pop. 1925, 72,341.

**ASAPH**, a Hebrew name, signifying collector, borne by the leader of David's choir (I Chronicles 6:39). A group of Psalms is attributed to him, and he is included among the prophets (II Chronicles 29:30). In the reign of Hezekiah there is mention of Joah, son of Asaph the recorder (II Kings 18:18) and an Asaph is also mentioned (I Chronicles 9:15, Nehemiah 11:17) as the ancestor of Mattaniah, leader of the Temple choir after the Captivity, who "was the chief to begin the thanksgiving in prayer." Apparently Asaph founded an important Levitical family. A different Asaph was keeper of the royal forest of Artaxerxes (Nehemiah 2:8) and seems to have been a Jew.

**ASAS**, in Scandinavian mythology, were the gods ruled by Odin at Asgard. They were distinguished from the Vans or the gods who lived in the sea. The Asas were also a people who were ruled by the historical Odin and who dwelt between the Pontus Euxinus and the Caspian Sea.

# ARUMS



PAINTED FOR THE NATIONAL ENCYCLOPEDIA BY MARY E. EATON

## NORTH AMERICAN ARUMS

1. Wild Calla (*Calla palustris*).
2. Jack-in-the-Pulpit or Indian Turnip (*Arisæma triphyllum*).
3. Golden Club (*Orontium aquaticum*).
4. Skunk Cabbage (*Symplocarpus foetidus*).



**ASBESTOS**, a heat resisting non-metallic mineral silicate including two general groups varying in composition and geologic occurrence. The Serpentine or Chrysotile group are hydrous silicates of MAGNESIUM, while the Amphibole group includes metasilicates of magnesium, CALCIUM, IRON, SODIUM and ALUMINUM, with little water of hydration. Crude asbestos is a fibrous crystalline aggregate occurring principally in Canada, South Africa, Russia, United States and Italy, where it is mined, crushed, and screened to separate the fibers. Because of the relative superiority of its inherent qualities, Chrysotile comprises more than 90% of the asbestos finding extensive industrial applications. In its commercial application, asbestos is utilized alone or mixed with other materials. Due to the fineness of the fibers, their strength, elasticity and flexibility, asbestos can be spun, woven or felted to form yarn, rope, cloth, blankets, sheets, tubes, boards, and other products. The fibers are also used for filtration and other purposes in chemical manufacturing processes, as well as for fillers in heat and chemical resisting cements, plasters, paints, and papers. Asbestos products find wide application where thermal, electrical and chemical resistance is essential in heat and electrical insulations, packing and gasketing materials, heat protective curtains, blankets and clothing, and felts, shingles, and boards for building construction.

E. C. R.

**ASBJÖRNSEN, PETER CHRISTEN** (1812-85), Norwegian folklorist and writer, was born in Christiania, Jan. 15, 1812. He published his first work, known as *Norwegian Popular Stories*, in collaboration with a friend, Jørgen Engebretsen Moe. This work was recognized throughout Europe as a valuable contribution to literature and mythology. Asbjørnsen's collection of Norwegian fairy tales published later was received with equal favor. Both Moe and Asbjørnsen have been praised for their narrative prose style. Asbjørnsen died in Christiania, Jan. 6, 1885.

**ASBURY, FRANCIS** (1745-1816), American Methodist bishop, was born in Staffordshire, England, Aug. 20 or 21, 1745. He prepared for church work by self-study and before he was 20 became an itinerant preacher in his community. In 1766 he was admitted to the Wesleyan Conference in London. In 1771 he was sent to America for missionary work where he continued his activities through the Revolutionary War period. When in 1784 it was necessary to found an independent Methodist Episcopal Church in America, he was ordained a bishop. His untiring efforts in the next 30 years gave great impetus to the growth of Methodism in America. He died at Spottsylvania, Va., Mar. 31, 1816.

**ASBURY PARK**, a seaside resort city of Monmouth Co., N.J., 35 mi. by water and 50 mi. by rail south of New York City. It occupies a level site extending about two miles along a broad sandy beach, indented by several small estuaries. The city is served by the Pennsylvania and the Central of New Jersey railroads, buses, and electric trolleys. There are numerous fine hotels, boarding houses, and cot-

tages accommodating many thousand summer residents. The city has substantial local trade and minor industries. In 1929 the manufactures reached a total of \$2,253,665; retail trade amounted to \$24,004,257. In 1929-30 the municipality made extensive improvements along the shore, including a new board walk, two convention halls, recreation pavilion and theater. A long-established local event is the annual baby parade. Asbury Park, named in honor of Bishop FRANCIS ASBURY, was founded in 1869 and received its municipal charter in 1879. Pop. 1920, 12,400; 1930, 14,981.

**ASCANIUS.** See IULUS.

**ASCENSION DAY** (*Ascensio Domini*), a movable feast of the Christian Church always commemorated on the fortieth day after Easter (Acts 1, 3). Homilies delivered on that festival by Gregory of Nyssa, St. Chrysostom and Epiphanius are still extant. During the Middle Ages various sorts of folk plays and amusements crept in, which diminished the dignity of the day. In Venice the ceremony of the marriage of the doge with the Adriatic Sea took place on Ascension Day, and was the beginning of the celebrated "Sensa," which was accompanied by a sort of carnival. In the Catholic Church at the High Mass celebrated in honor of the day, the paschal candle is extinguished after the singing of the Gospel, because the resurrected Jesus departed from the earth. It is one of the Days of Obligation of the Catholic Church.

**ASCENSION ISLAND**, a British possession in the South Atlantic, 750 mi. northwest of St. Helena. It covers an area of 35 sq. mi. Of volcanic origin, Ascension is surmounted by a crater, Green Mountain, which rises 3,000 ft. above sea level. There are only about ten acres of land under cultivation, producing fruits and vegetables. Phosphate deposits have been found and investigations are conducted for possible development. George Town is the chief settlement, and the entire population numbers less than 300. For administrative purposes the island is attached to St. Helena.

**ASCETICISM**, from the Greek *askesis*, originally the training of athletes; later, training for virtue and piety from religious motives, to curb the desires of the flesh and to exercise self-control. Where the value of the life of the individual is denied, as in Buddhism, or the dualistic view of life tends toward the belief that life in the body is worthless, asceticism flourishes. Traces of it are found in nearly all religions. Various Greek sects practiced and advocated vegetarianism, and among the Jews the PHARISEES and others had periods of fasting and self-denial. The ESSENES advocated strict asceticism. In the Christian religion various attitudes were taken. John the Baptist led an ascetic life. The teachings of Jesus did not emphasize asceticism, though he himself fasted, gave instructions regarding fasting and also referred to continence for the "kingdom of heaven's sake." St. Paul also praised abstinence as a virtue, but admitted that it was not attainable by all, though he did not lay much weight on fasting as of religious value. The

Christian Jews on the whole, however, retained fasting and the Gnostic sects adopted it, and sometimes continence also. The early Church was, moreover, influenced by Greek writers of the time and retained fasting, also advocating continence before marriage. Increasing emphasis on asceticism, beginning in the 2nd century, brought about the distinction between the ordinary Christians and those who led the religious life according to canon law: "A stable mode of life in community, whereby the faithful undertake to observe, not only the general precepts, but also the evangelical counsels by means of the vows of obedience, chastity and poverty." Many centuries later, after bitter quarrels, the Catholic Church decreed chastity for the secular clergy. The religious orders practised asceticism, not as an end in itself, but as a means of fulfilling the chief commandments of Jesus.

**ASCHAFFENBURG**, a Bavarian city situated on the Main River about 23 mi. northeast of Darmstadt. It belonged to the archbishops of Mainz from about 982, but was annexed to Bavaria in 1814. It has numerous half-timbered houses and many factories. Since 1921 the city has been the provisional terminus of the Rhine-Danube Canal. Above the Main rises the castle, a notable example of German Renaissance architecture, built between 1605 and 1614, a favorite residence of the archbishop-electors of Mainz. The library contains rare books and manuscripts and the picture gallery has excellent paintings. The Collegiate Church of St. Peter and Alexander, mentioned in 974, has a nave of the 12th century and an early-Gothic 13th-century choir. Pop. 1925, 34,600.

**ASCHAM, ROGER** (1515-68), English scholar and writer, was born at Kirby Wiske, Yorkshire, in 1515. He graduated (M.A.) from St. John's College, Cambridge, in 1537 and the following year was Greek reader at the college. In 1546 he was made public orator in the University of Cambridge, holding this position until 1554. From 1548-49 he tutored Princess (later Queen) Elizabeth and in 1550 was made secretary to Sir Richard Moryson, ambassador to Charles V. After traveling extensively in Italy and Germany he became in 1553 secretary to Queen Mary, and after her death secretary and tutor to Queen Elizabeth. Ascham was the first great English writer on education. His *Scholemaster*, 1570, in which he presented the double translation method of teaching Latin, brought him widespread recognition. He died in Dec. 1568.

See "Life" by Edward Grant in *The Collected Works of Ascham*, edited by J. A. Giles.

**ASCHERSLEBEN**, an industrial city in the Prussian province of Saxony, about 35 mi. north and west of Halle. There are large potash mines in the vicinity and the city has factories which produce iron goods, beet sugar, vinegar, chemicals and textiles. It has a rathaus of 1518 and a church built at the end of the 13th century. Pop. 1925, 28,630.

**ASCIDIANS**, the name for animals belonging to an order (*Ascidacea*) of tunicates. There are over 1,000 species, many of which are found in shallow

water, while some live in the deep sea. Those forms popularly known as sea squirts are solitary; other ascidians form colonies by budding. They are degenerate, sedentary creatures, which, in looks, have been well compared to leather bottles with two necks. The necks are their two siphons, one inhalant, the other exhalant. A current of water constantly passes through the body, carrying small organic particles on which the animal feeds.

Like other tunicates, ascidians are hermaphroditic. The young larva is a free-swimming animal, something like a tadpole. It is more highly organized than the adult, and shows that these animals, long thought to be mollusks, are allied to backboneed animals. Soon it settles down, loses its vertebrate-like structures, and becomes a degenerate adult. See also **TUNICATES**.

**ASCITES**, the accumulation within the abdominal cavity of fluid other than pus. If the fluid is pus, the condition is termed **PERITONITIS**. The blood passing through the capillaries of the stomach and intestine, returns to the heart by way of the portal vein, but on its way it again passes through a network of capillary-like sinusoids within the liver (see **PORTAL SYSTEM; VEINS**). Any condition which would dam back the return of venous blood and increase the pressure and cause stagnation within the capillaries of the intestine would naturally aid the filterable portions of the blood to pass through the thin capillary and peritoneal walls, and so into the abdominal cavity. This is the mechanism of ascites. Specific disease conditions which cause this condition are cirrhosis of the liver, in which the flow through the liver is impaired; heart disease, in which inefficiency of pumping action of the heart blocks the return flow; and growths of the abdominal organs, which press on the tributaries of the portal vein directly.

The accumulation is relieved by perforation of the abdominal wall with a small hollow trocar.

**ASCOLI PICENO**, a city of Italy, capital of the province of the same name, on a mountain spur between the valleys of the Tronto and the Castellano. It is seat of a bishop and besides Roman remains has beautiful churches, chiefly Romanesque, 10th-13th centuries, although the cathedral was built in the 16th century. Ascoli Piceno was the Asculum of the ancients. Christianity was introduced in the 4th century by St. Emidio, the first bishop and patron of the city. Passing through various hands, Ascoli Piceno became a free community in 1185, but was again involved in wars with various powers and principalities until it became part of the **PAPAL STATES** in 1502. In 1860 it merged with United Italy. Pop. 1931, 36,965.

**ASGARD**, in Scandinavian mythology, the home of the gods or **ASAS**. Asas was supposed, like Olympus, to be the center of the earth. The palace was called Gladsheim and was the residence of **ODIN** and the 12 **AESIR**. The goddesses' palace was Vingolf. Valhalla was the home of the heroes who fell in battle.

**ASH**, a large genus (*Fraxinus*) of forest trees of the olive family yielding valuable hard wood timber



and handsome ornamentals. There are about 65 species, natives chiefly of the north temperate zone, about one third of which are found in North America.

They are mostly small to medium-sized trees, though a few are shrubby and others attain a height of 120 to 140 ft. The erect, slender trunk, with thick furrowed bark, produces ash-colored branches bearing opposite, pinnate leaves of several leaflets, small flowers in clusters and a narrow, winged fruit (samara).

Although most species of ash bear inconspicuous, greenish flowers, the Himalaya ash (*F. floribunda*) of central Asia, the foothill ash (*F. dipetala*) of the California mountains, and the southwestern flowering ash (*F. cuspidata*) of the Mexican border, bear showy white flowers; those of the last named species are extremely fragrant.

Several species are important timber trees; the flowering ash (*F. Ornus*) of the Old World furnishes the manna of commerce used in medicine, and the Chinese ash (*F. chinensis*) yields the Chinese white wax.

The most important North American species is the white ash (*F. americana*), found widely throughout the eastern and southern states, yielding a hard, strong, close-grained wood extensively used in making agricultural implements, tool handles, furniture and interior finish. Other native species producing useful timber are the green ash (*F. pennsylvanica* var. *lanceolata*) of the southern states, the black ash (*F. nigra*) of the northeastern states and the Great Lakes region, and the Oregon ash (*F. oregona*) of the Pacific coast. In the eastern United States the white ash is frequently planted for shade and ornament, as are also the European ash (*F. excelsior*), a magnificent tree sometimes 140 ft. high with numerous foliage varieties, and the flowering ash (*F. Ornus*).

In 1930 the total cut of ash lumber in the United States amounted to 115,633,000 bd. ft. which sold at the mill at the highest average price of any American timber except black walnut.

The name ash is applied to various non-related trees as the mountain ash (*Pyrus Aucuparia*), of the rose family; the poison ash (*Rhus Vernix*), of the cashew family; the Cape ash (*Ekebergia capensis*), of the mahogany family, and the bitter ash (*Simaruba excelsa*), of the quassia family.

**ASH, VOLCANIC**, a misnomer for certain products of volcanic eruptions. Ash implies that the material is the residual product of a process of combustion, which is incorrect. A mass of molten rock, or magma, beneath the surface of the earth becomes so highly charged with vapors, mostly steam, that the pressure is sufficient to produce an explosive volcanic eruption, blowing the liquid magma violently into the air. The fragments cool and solidify as they fall back to earth, the smaller ones looking like cinders, whence the name ash. Minute pieces are usually glassy. In decreasing size the fragments are called volcanic bombs, lapilli, volcanic ash, sand and dust. Pieces the size of peas or shot are called ash.

Accumulations of volcanic ash, sand and dust may attain considerable thickness. When compacted they are called TUFF. Polishing material and scouring soaps are made of volcanic ash, which is mined in Nebraska. It is common in most volcanic regions and occurs in many western States. See also PUMICE; VOLCANO; LAVA.

**ASHANTI**, a British territory in west Africa, formerly an independent native kingdom, lying inland between the GOLD COAST and its northern territories. The area is 24,560 sq. mi. Pop., Akan Negroes, 407,000; Europeans, 400. The chief town is KUMASI, or Coomassie, with about 25,000 inhabitants.

The country is hilly and covered with tropical vegetation, in which roam the elephant, rhinoceros, lion, giraffe, hippopotamus and buffalo and crocodile inhabit the streams. Mahogany and cedar are plentiful. Gold is mined, but the output is decreasing. Agriculture is the staple industry, products being maize, yams, coco-yams and bananas. The native industry of coco culture prospers; in 1913 about 90,000 tons were produced, and in 1929, 65,872 tons were exported.

Ashanti has always constituted a menace to the European forts along the Gold Coast and to the coast tribes which they protected. The transfer of the Dutch settlements to Great Britain gave offense, and an Ashanti army invaded the British lands early in 1873. It was defeated and driven back. In 1896 an English force occupied Kumasi, deposed the king, and set up a loose protectorate, over which a more definite supervision was placed in 1901. The governor of the Gold Coast Colony is the governor of Ashanti, and for educational purposes Ashanti is considered part of the Gold Coast.

**ASHBURTON, ALEXANDER BARING, LORD** (1774-1848), English diplomat, was born at London, Oct. 27, 1774. He became president of the Board of Trade and master of the mint in the cabinet of Sir Robert Peel and in 1842 was sent as special commissioner to the United States where he negotiated the Webster-Ashburton treaty which determined definitely the dividing line between Maine and Canada. He died at Longleat, May 13, 1848.

**ASHBY-DE-LA-ZOUCH**, an urban district of Leicestershire, England, on the Mease, 118 mi. north-west of London. As Essebi it belonged to the De-La-Zouch family, and in 1461 was granted to Lord Hastings who built the castle which figures in Sir Walter Scott's *Ivanhoe*, and which survives to-day in picturesque fragments. Among other antiquarian interests, Perpendicular St. Helen's Church boasts an ancient finger pillory, and a unique 15th century pilgrim's effigy. Southwest, the saline springs of the modern Ivanhoe Baths make Ashby something of a health resort, but its primary commercial interests center in the coal mines of the adjacent neighborhood. Pop. 1921, 4,983; 1931, 5,093.

**ASHEBORO**, a city and the county seat of Randolph Co., in central North Carolina, situated about

26 mi. south of Greensboro. Two railroads serve the city. Corn, small grain, tobacco and dairy cattle are raised in the vicinity, while hosiery and furniture are the principal manufactures. The city was incorporated in 1783. Asheboro was at one time the home of **ANDREW JACKSON**. Pop. 1920, 2,559; 1930, 5,021.

**ASHER**, the eighth son of Jacob by Zilpah, handmaid of Leah, and the hero of the tribe of Asher, one of the 12 tribes, settling on the seacoast south of Tyre and in touch with that source of maritime prosperity. On his deathbed (Genesis 49:20), Jacob prophesied that Asher would "yield royal dainties."

**ASHEVILLE**, a city and the county seat of Buncombe Co., in western North Carolina. It is situated at the junction of the French Broad and Swannanoa rivers, 120 mi. northwest of Charlotte, N.C. The Southern Railroad and bus lines serve the city. The Asheville-Hendersonville Airport is located 11 mi. south of the city. Asheville is a trade center for a farming district raising vegetables, fruit, burley tobacco and poultry. Dairying is a profitable industry. The city has factories turning out cotton products, paper, furniture, hose, rayon, homespun and blankets. In 1929 the value of the manufactures was about \$8,000,000; the retail trade amounted to \$28,557,154. It is a summer and winter resort in the Blue Ridge Mountain region. Great Smoky Mountains National Park, Pisgah National Forest, Mt. MITCHELL, highest peak east of the Rockies, and Chimney Rock Mountain are spots of great beauty and interest in the vicinity. See MOUNT MITCHELL PARK. O. Henry, the short-story writer, is buried in Asheville. The famous Biltmore house and estate are located near here. Asheville was founded in 1794 and incorporated in 1797. Pop. 1920, 28,504; 1930, 50,193.

**ASHKHABAD**, capital of Turkmen Soviet Socialist Republic, on the oasis of Ashkhabad in its south central portion. It was founded by Russians about 1880, but the neighborhood shows evidences of prehistoric and ancient settlements. Of interest is a handsome 15th-century mosque erected by Tamerlane's great-grandson. The extensive exportation of local products such as bricks, mineral water, leather and cotton is due to Ashkhabad's good roads and its location on the Central Asiatic Railway which extends through Uzbekistan and Turkmenistan, connecting Tashkent with the Caspian Sea. Pop. 1930, 62,693.

**ASHLAND**, a city in Boyd Co., northeastern Kentucky, situated on the Ohio River, near the mouth of the Big Sandy River, 146 mi. southeast of Cincinnati, O. Three railroads, bus and truck lines and river craft serve the city. There are 60 gas wells within the city's limits, and the vicinity has coal, iron, asphalt, hardwood timber and limestone. The principal manufactures are iron, steel, tannery products and coke. In 1929 the factory output amounted to \$10,000,000; the retail trade was valued at \$13,959,623. Ashland was incorporated in 1856. The city is built around a beautiful blue grass park containing a fine forest and several Indian mounds. Pop. 1920, 14,729; 1930, 29,074.

**ASHLAND**, a city of north central Ohio and the county seat of Ashland Co., located 46 mi. southwest of Akron. It is on the Lincoln highway and is served by the Erie Railroad. Ashland is the trading center of an agricultural region having natural gas and oil resources, and manufactures toys, golf balls, automobile and farming tools and livestock remedies. In 1929 the retail trade amounted to \$7,398,616. Ashland College was established here by the United Brethren in 1878. Mohican State Forest Park is located in the southern part of Ashland Co., and Savannah Lakes are about 6 mi. north of the city of Ashland. Pop. 1920, 9,249; 1930, 11,141.

**ASHLAND**, a city in Jackson Co., southwestern Oregon. It is situated near Bear Creek, 13 mi. southeast of Medford; served by the Southern Pacific Railroad. The city is surrounded by the magnificent peaks of Siskiyou Mountains. The mineral springs within the city are municipal property. Fruit is the chief crop of this region, and gold and granite are mined in the vicinity. In 1925 the Southern Oregon Normal School was founded in Ashland. The city, settled in 1852, was incorporated in 1874. Pop. 1920, 4,283; 1930, 4,544.

**ASHLAND**, a borough in Schuylkill Co., in eastern Pennsylvania, situated 62 mi. southwest of Wilkes Barre, in an anthracite coal region. Bus lines and two railroads afford transportation. Ashland stands high above sea-level in the Mahanoy Valley. Beneath it is a coal bed 1,800 ft. deep and over 100 ft. in thickness. Mining is the principal industry. The borough is the seat of the Ashland State Hospital. Ashland was founded in 1845 and incorporated in 1857. Pop. 1920, 6,666; 1930, 7,164.

**ASHLAND**, a city in northern Wisconsin, the county seat of Ashland Co., situated on Chequamegon Bay, an arm of Lake Superior, about 30 mi. northwest of Hurley. Bus lines, lake steamers and three railroads afford transportation. The chief crops of this region are grain and potatoes. The local industries include paper manufacture, granite finishing and coal and iron ore shipping. For 1929 the factory output reached an approximate total of \$2,800,000; the retail trade amounted to \$5,749,478. Ashland is the seat of Northland College. The Apostle Islands, a group of twenty in Lake Superior, can be seen from the city. Once the meeting place of the Ojibwa Indians, the islands are now attractive summer resorts. Ashland was settled in 1854; incorporated in 1887. Pop. 1920, 11,334; 1930, 10,622.

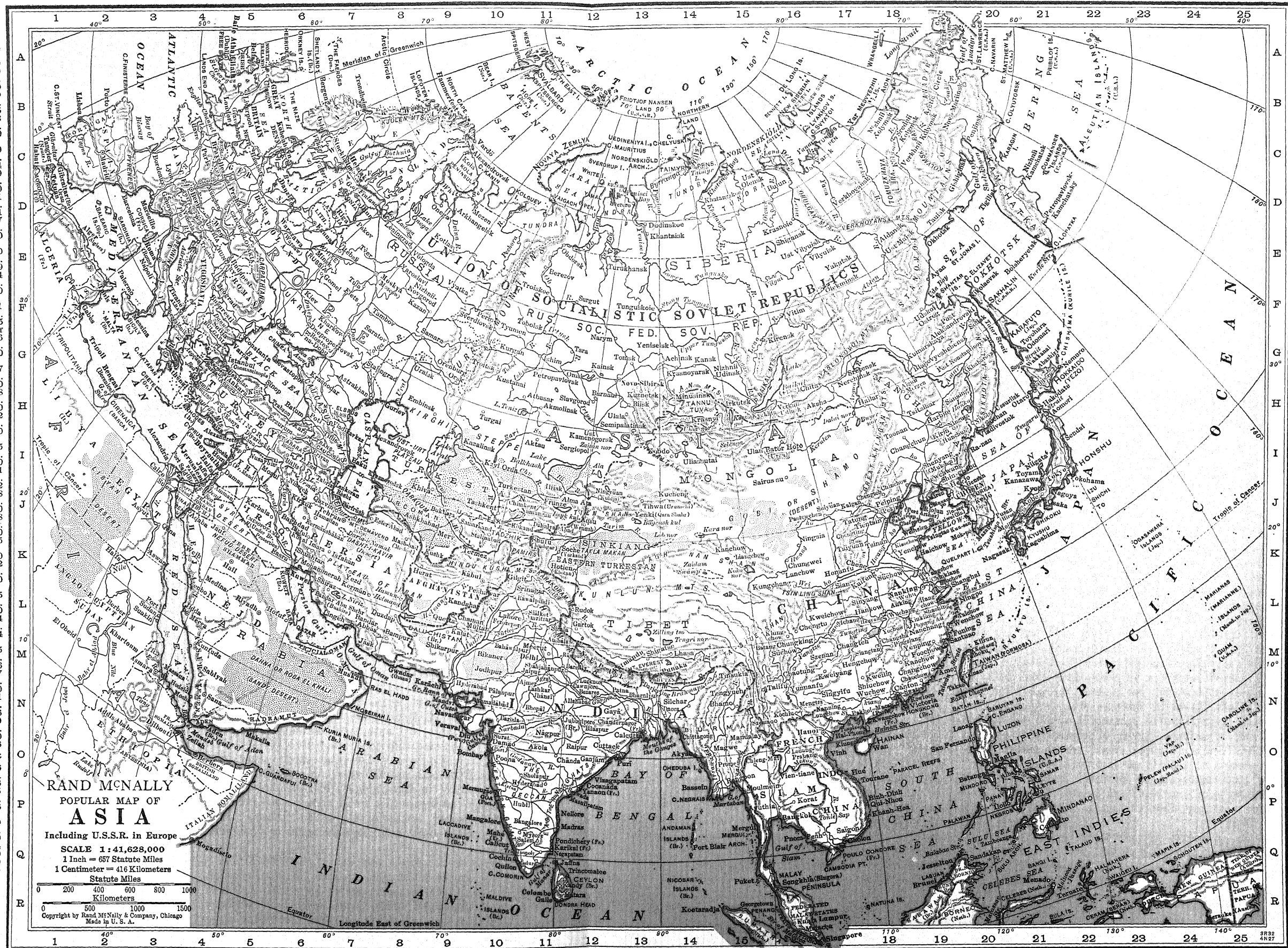
**ASHLEY**, a borough in Luzerne Co., northeastern Pennsylvania, situated 2½ mi. south of Wilkes-Barre near the Susquehanna River and served by one railroad. Coal-mining is the important industry, and there are also railroad shops. Pop. 1920, 6,520; 1930, 7,093.

**ASHTABULA**, a city and Great Lakes port of Ashtabula Co., O., on Lake Erie, at the mouth of the Ashtabula River, 55 mi. northeast of Cleveland. It is on the New York Central, Nickel Plate, and Pennsylvania Railroad lines, and its harbor has an advan-



ASIA  
Ar. 16,205,512 sq. m.  
Pop. 1,072,737,246

- COUNTRIES**
- ADEN.....N 4  
Area...9,075 sq. m.  
Pop....150,809
- AFGHANISTAN..L 9  
Area 245,000 sq. m.  
Pop....19,500,000
- BAUUCHISTAN..M 9  
Area 134,638 sq. m.  
Pop....799,625
- BRUTAN.....M 13  
Area 18,000 sq. m.  
Pop....300,000
- BRITISH NORTH  
BORNEO....Q 19  
Area 31,106 sq. m.  
Pop....257,804
- BRUNEI.....R 19  
Area 2,500 sq. m.  
Pop....30,000
- CEYLON.....R 11  
Area 25,332 sq. m.  
Pop....5,306,871
- CHINA.....L 17  
Ar. 4,279,170 sq. m.  
Pop....489,500,000
- CHOSIN (Korea)  
J 20  
Area 85,206 sq. m.  
Pop....21,057,989
- CYPRUS.....I 4  
Area 3,584 sq. m.  
Pop....330,000
- EAST INDIES  
DUTCH....R 21  
Area 733,642 sq. m.  
Pop....60,731,025
- FEDERATED MALAY  
STATES....R 16  
Area 27,506 sq. m.  
Pop....1,470,000
- FRENCH INDO  
CHINA....P 17  
Area 284,816 sq. m.  
Pop....20,351,000
- HONG KONG..N 18  
Area 391 sq. m.  
Pop....1,143,500
- INDIA.....N 12  
Ar. 1,802,629 sq. m.  
Pop....351,500,000
- IRAQ (Mesopotamia)  
J 5  
Area 143,250 sq. m.  
Pop....3,300,000
- JAPAN (Empire) J21  
Area 377,915 sq. m.  
Pop....88,584,502
- KWANGCHOW..N 18  
Area 325 sq. m.  
Pop....205,000
- LABUAN.....Q 18  
Area 30 sq. m.  
Pop....5,900
- NEID.....L 5  
Area 3,000,000  
Pop....12,000,000
- NEPAL.....M 12  
Area 54,000 sq. m.  
Pop....5,600,000
- NEW GUINEA  
TERRITORY..Q 25  
Area 91,000 sq. m.  
Pop....490,000
- PALISTINE..J 4  
Area 9,000 sq. m.  
Pop....1,035,154
- PAPUA TERRI-  
TORY.....R 25  
Area 90,540 sq. m.  
Pop....276,366
- PERSIA.....K 7  
Area 628,000 sq. m.  
Pop....10,000,000
- PHILIPPINE IS. P21  
Area 114,400 sq. m.  
Pop....12,082,366
- SARAWAK....R 19  
Area 42,000 sq. m.  
Pop....600,000
- SIAM.....P 16  
Area 200,148 sq. m.  
Pop....11,506,207
- STRAITS SETT. R 16  
Area 1,600 sq. m.  
Pop....1,168,806
- SYRIA.....L 5  
Area 57,460 sq. m.  
Pop....2,897,956
- TAIWAN  
(Formosa) M 19  
Area 13,836 sq. m.  
Pop....4,337,000
- TRANSJORDAN..J 4  
Area 16,220  
Pop....300,000
- TURKEY (Asia) H 5  
Area 285,161 sq. m.  
Pop....12,615,969
- UNION OF SOVIET  
REPUBLICS IN  
ASIA.....F 14  
Ar. 6,530,852 sq. m.  
Pop....38,891,655







tageous position for the transfer of iron-ore from the upper Lake region to the Pittsburgh district mills, and of coal from western Pennsylvania and Ohio fields to the Lake markets. Shipyards, railroad shops, iron- and steel-works and tanneries comprise the city's major industries. In 1929 the value of manufactures was about \$12,000,000; the retail trade amounted to \$15,313,815. Ashtabula means *fish river* in Indian, and fishing is an important industry. Ashtabula county leads the state in dairying and grape production, and in the vicinity of Ashtabula city vegetable greenhouses cover approximately 65 acres. Pioneers of New England stock settled here at the opening of the 19th century during the period 1798 to 1801. The village of Ashtabula became a city in 1891. Pop. 1920, 22,082; 1930, 23,301.

**ASHTON-UNDER-LYNE**, a municipal borough of Lancashire, England, on the river Tame, 185 mi. northeast of London. Here picturesque old houses survive, one market dating from 1436; but although a chapel existed as early as 1261-62, the Church of St. Michael is entirely modern as are a technical school, public library and several hospitals. Ashton's ancient industry was in woollens, but since 1769 machine weaving of cotton yarn has been important. Iron-founding, hat-making, machinery works and collieries are among the town's occupations. Pop. 1921, 51,409; 1931, 51,573.

**ASH WEDNESDAY**, the Wednesday after Quinquagesima Sunday, the first day of Lent. According to Catholic custom the palms used on the previous Palm Sunday are burned and the ashes, retained in a vessel, are blessed before High Mass. The worshiper kneels at the altar and receives from the thumb of the priest the sign of the cross in ashes on the forehead, or in the case of the clergy, on the place of the tonsure. The priest utters the sentence: *Memento, homo, quia pulvis es, et in pulverem reverteris*, translated, "Remember man, that thou art dust and unto dust shalt thou return." In the Anglican churches Ash Wednesday is celebrated by a Communion Service denouncing sin, which liturgy, save for certain prayers, has been omitted from the Protestant Episcopal Prayer Book in the United States.

**ASIA**, the eastern part of the vast land mass of Europe and Asia. The Asian part of the Eurasian continent is bounded on the north, east and south by the Arctic, Pacific and Indian oceans respectively. On its western side it is marked off from Europe by the Ural and Caucasus mountains and the Caspian and Black seas. The Red Sea to the southwest separates it from Africa. The northernmost point of Asia, Cape Chelynskin in Siberia, at 77° 34' N. lat., comes within 870 mi. of the north pole, and the most southern point, Cape Buru, at 1° 15' N. lat., is within 83 mi. of the Equator. The extreme north-south distance is about 5,260 mi. The extreme east-west distance is approximately 6,800 mi., measuring from Cape Baba in Asia Minor at 26° E. long., to East Cape, Siberia, at 120° W. long. The total area of Asia is approximately 17,300,000 sq. mi., or one-third

of the land surface of the globe. The northeastern peninsula of Asia reaches within 36 mi. of North America, from which it is separated by the Bering Strait.

Because of its position in relation to Europe, Asia also is called the East, or the Orient. It is subdivided, in common parlance, between the Far East and the Near East, the latter section also being called ASIA MINOR. The Far East usually is understood to include the regions bordering on the Pacific and Indian oceans such as eastern Siberia, China, Japan, India and the lands to the south and east of these countries. The Near East includes the countries bordering on the Mediterranean Sea and lying in the region to the east and northeast of this, as far as the Indus River and the Himalayan Mountain section. The boundaries between Near and Far East are not sharply drawn. Russia and Turkey are the only countries having territory definitely in both Europe and Asia.

**Surface Features.** Asia has the highest elevation and the lowest depression on the face of the earth. Mr. EVEREST in the Himalayas towers to 29,141 ft., while the DEAD SEA in Asia Minor lies 1,293 ft. below sea level. Between them is a difference of 5¾ mi. The heart of Asia is the great Central Asiatic Plateau, from which lesser mountain-rimmed table-lands branch off westward into Turkey and Persia, southwest and southward into Afghanistan and northern India, southeastward into Tibet, eastward and northeastward into China and Mongolia and northward into the steppe country of Siberia. The steppes slope off northward to forest and then to barren tundra country. Mountain ranges on the other sides of the vast series of plateaus slope down to plains country, across which run many of the principal rivers of the world. The Himalaya Mountains, rising fairly abruptly on their southward slopes, spread northward and throw off branch ranges which reach out like the fingers of a great hand. East of these mountains are the river plains of the AMUR RIVER, the Huang Ho (Yellow River), the Yangtze Kiang, the Si KIANG, and the Mekong, Menan and Salwin rivers, separated from each other by mountain spurs. To the south are the plateaux of the Arabian, Indian and Malay peninsulas, marked off by the plains region of the Tigris, Euphrates, Indus, Ganges, BRAHMAPUTRA and Irrawaddy rivers. Arabia is chiefly desert, similar to the Sahara region in North Africa. Peninsular India, known as the DECCAN, is a triangular-shaped plateau, bounded on all three sides by mountains. The Malay Peninsula is a long narrow strip of land with a mountainous backbone and heavy tropical jungles. G. C.

The plateau and mountain belt centers in northwestern India in the Pamir Knot which is called the "roof of the world" because of its mean elevation of over 11,000 ft. The Himalayas, reinforced by the Karakoram chain on the northwest, run southeastward to form the boundary line between India and the plateau of Tibet. The latter is the highest



plateau in the world, the elevation of the plateau varying from 9,000 to 17,000 ft. above sea level. North of Tibet are the Kuenlun Mountains between which and the Altyn Tagh and Nan Shan ranges is the Tsaidan Desert basin. The mountains which surround it merge at the east into the Tsinling chain which, with the Great Khingan, Chang Pai and Stanovoi ranges, run to the northeastern coast.

North of the Altyn Tagh and Nan Shan mountains is the great plateau of Mongolia, 3,000 to 4,500 ft. high, separated from Manchuria on the east by the Khingan Mountains, and from Siberia on the north and west by a series of short ranges aligned obliquely to the boundary line. Of these the Thian Shan, Great Altai and Sayan mountains are the most prominent. The plateau is divided into the Tarim and Dzungarian basins to the west and the Gobi Desert to the east.

West of the Pamir Knot, the Hindu Kush Mountains stretch across Afghanistan and continue through northern Persia as the Elburz Mountains. The latter range gives off the lofty Caucasus branch to the northwest and terminates in the Armenian Knot. Between the Elburz and the broken mountain chains bordering the Arabian Sea and Persian Gulf is the plateau of Iran and the plateau basins of Afghanistan and Baluchistan. West of the Armenian Knot the Pontic Mountains parallel the coast of the Black Sea, the Taurus ranges border the coast of the Mediterranean, and between them lies the plateau of Anatolia. On the border line between Persia and Russia is Mt. Ararat, 17,090 ft. high.

This continuous wall of mountains and plateaus completely separates the lowland of northwestern Asia from the plains of the east and south, between which communication is possible only by mountain passes. In Afghanistan, slightly south of the Kabul River, is the Khyber Pass 3,373 ft. high. The Bolan Pass, 6,000 ft. high, connecting Jacobabad on the plains of the Indus with Quetta in Baluchistan, is now crossed by a railroad. The famous Karakorum Pass, 18,000 ft. high, is in Kashmir and between the Thian Shan and Altai ranges is the Terek Pass through which the Huns and Mongols migrated to western Asia and eastern Europe.

Out of the central highlands of Asia issue some of the longest rivers in the world. Those flowing to the Arctic Ocean include the Ob, 2,500 mi. long, the Yenisei, 3,000 mi. long, and the Lena, 2,800 mi. long, all of which have short upper courses through the mountains and very long courses across the plains. They freeze over in winter, but the upper portions thaw first in the spring. Consequently, the central and lower portions of the rivers overflow and spread over enormous areas of the level, swampy northern country. The rivers flowing eastward to the Pacific have long courses on the plateaus and plains. The Yangtze Kiang, 3,200 mi. long, passes through a series of basins before reaching the sea. Others are the Amur, 2,920 mi. long, the Hwang Ho (Yellow River), 2,500 mi. long, the Mekong, 2,600 mi. long

and the Si Kiang, 1,120 mi. Those discharging into the Indian Ocean rise beyond the first rampart of mountains, are fed by snows and the monsoon rains, and come down in flood in summer. They include the Salwin, 1,750 mi. long, the Irrawaddy, 1,250 mi., the Brahmaputra, 1,800 mi., the Ganges, 1,500 mi., the Indus, 1,700 mi., the Euphrates, 1,700 mi., and the Tigris, 1,150 miles. In the drier regions they supply water for irrigation.

South of the Kirghiz Steppes, in Russian Turkestan, there is a region of internal drainage. Much of it was once covered by a great sea of which the Caspian and Aral seas and Lake Balkash are remnants. Having no outlets, their waters have become saline. Of the fresh water lakes, Baikal in Siberia is noted for its great depth. Soundings of nearly 5,000 ft. have been taken.

The coast line of Asia, measuring over 33,000 mi., is exceedingly irregular. The low, flat northern shore is cut by river estuaries and the Gulf of Ob. Along the eastern margin there are two coast lines, that of the mainland and that of the islands which lie in wreaths along the margin of the continental block. Between the outer and inner shores is a series of seas. The Sea of Okhotsk is shut in by the Kamchatka Peninsula and Kurile Islands; the Japan and China seas lie behind the empire of Japan; and the South China Sea separates the Philippine Islands and Borneo from the mainland. The southeastern line of islands includes the Philippines and Moluccas and within it lie the seas of Sulu and Celebes. The bold, convex arc of the Sundra Islands encloses the Banda and Java seas. The islands off the southeastern coast of Asia form a great archipelago between the mainland and Australia. These and the groups along the eastern margin owe their origin chiefly to volcanoes, many of which are still active.

On the southern coast the tapering peninsula of India and the Island of Ceylon separate the Bay of Bengal from the Arabian Sea. The latter body has a northwestern arm consisting of the Persian Gulf and the Gulf of Oman, which lie between Persia and Arabia.

For a discussion of the geology and additional details regarding the physiography of the continent, see E. Suess, *The Face of the Earth*, 1904-24; Prince Kropotkin, *The Orography of Asia*, 1904; F. von Richthofen, *China*, 1877-1912; A. D. M. Carruthers, *Unknown Mongolia*, 1913; Sven Hedin, *Southern Tibet*, 1919; J. W. Gregory, *The Alps of Chinese Tibet*, 1923; H. B. Medlicott, et al., *Manual of the Geology of India*, 1893; E. Huntington, *Asia; A Geographical Reader*, 1912.

**Climate.** The lofty barrier of mountains and plateaus which reach laterally across Asia has a marked effect on the climate. North of this wall the winters are exceedingly cold since the influence of equatorial oceans is absent and since the region is one of high pressures and rapid radiation. Conversely, to the south, the climate is hot through being deprived of Arctic winds. In the equatorial zone, Singapore has a mean annual temperature of 80° F., Bombay and Rangoon average 79° with a range of only 10° throughout the year; Hongkong

averages  $72^{\circ}$  with a range of  $24^{\circ}$  and Hué  $78^{\circ}$  with a range of  $17.6^{\circ}$ . The plateau of Arabia, in the subtropical zone, has a hot desert climate, and the high plateaus of central and southeastern Asia have a temperate desert climate. On lofty Tibet, due to the rarity of the atmosphere, the ground temperature in the sun may be over  $130^{\circ}$  while it is below freezing in the shade. The coasts of Asia Minor and Syria have a Mediterranean climate, that is, dry summers and rainy winters. Farther north the range in temperature increases until at Verkhoyansk at  $67^{\circ} 50' N.$  lat. there is a difference of  $119^{\circ}$  between the mean of the coldest month,  $-59^{\circ}$ , and the mean of the warmest month,  $60^{\circ}$ .

In the winter the whole of central and northern Asia is covered by a great blanket of cold air centering over the Gobi Desert and southern Siberia. This heavy compressed atmosphere flows out in all directions, giving rise to cold dry winds blowing outwards from central Asia. They are especially strong and continuous over northern China but do not reach India because of the Himalayas. Since they carry no moisture, they cause Asia to be almost rainless in winter. In summer the huge land areas heat rapidly, and the high pressure area is replaced by a low. The out-blowing winds gradually cease and then suddenly the wind direction is reversed as the summer monsoon "bursts" and the moisture-laden winds from the oceans flow over the land, bringing rain to practically the whole continent. The amount differs greatly in different regions. It is high in India where the monsoon has particular violence and where the winds are cooled as they strike the Himalayas, but low in the heart of Asia which is shut in by the mountain ramparts. On the plateau of Tibet in Turkestan and western Mongolia the annual rainfall is very small. South and east of the Himalayas the rainfall is much heavier. Bombay has a mean annual precipitation of 74.1 in., Rangoon 98.8 in., Hongkong 90.2 in., Hué 101.9 in. and Singapore 92.9 in. Along the eastern coasts not shut in by the mountain wall Shanghai receives 44.1 in. per year, Peking 24.8 in. and Vladivostok 15 in.

The steppe lands of western Siberia average about 10 in. annually. Thus they can produce grass but do not receive sufficient moisture to grow trees. Here the winters are long and severe and the summers short and warm. Farther north in the cold temperate belt where forests of evergreens prevail, the rainfall is scanty, but since there is little evaporation the aridity is not pronounced.

**Flora.** In general the glacial soils of the north and east support forests, the æolian soils of the center and southwest are either steppes or deserts, and the laterite soils of the south and southeast are usually densely forested. But the character of vegetation on each of these soils is controlled by the climatic factors of temperature and rainfall. In the arctic zone the frozen soil thaws at the surface only during a brief period in the summer. Here the characteristic plants are mosses and lichens interspersed with very

low shrubby forms of birch, willow, larch and spruce, and small berry-bearing bushes, as the crowberry and cranberry, the whole constituting the plant association known as TUNDRA.

In the less severe Siberian climate forests develop wherever loamy soils occur. At the north these forests consist of coniferous trees, chiefly pine, larch and fir, sparsely mingled with birches, poplars and other deciduous trees, which become more abundant in the south. These form the TAIGA, a great forest area extending across Siberia immediately south of the tundra belt, but north of the western steppes and the central and eastern highlands. On the æolian soils bordering the taiga on the south are vast areas of grassy steppes or pasture lands; these lie chiefly between  $50^{\circ}$  and  $55^{\circ} N.$  lat. Southward the grassy steppes merge into the vast deserts which extend from the Red Sea through central Asia to the Gobi or Mongolian region. These extremely arid regions have very scant vegetation, with characteristic plants, as the saxaul, in the saline areas. In Arabia there are date-palm oases, but the high Tibetan plains have a desolate tundra-like aspect.

The subtropical forest area comprises the Mediterranean region, with olives, figs, pomegranates, myrtles, cedars and live oaks, and the Sino-Japanese region, with tea trees, lacquer trees, tung-oil trees and camellias. The moist slopes of the Himalayas abound in forests containing DEODAR, sal, and showy rhododendrons. South of the Himalayas the vegetation is distinctly tropical, with savanna areas in India and Indo-China, merging into wet jungles in the southeast. Teak and the ARECA PALM are found in the Dekkan and Burma. In the humid lower parts of southern and southeastern Asia there is an immense profusion of palms, banyans, screwpines, orchids, clubmosses and ferns. This rich vegetation extends sometimes to an elevation of 3,000 ft. in the mountains.

**Fauna.** Because of its vast area and marked extremes of climate, Asia possesses an immense diversity of animal life. In the arctic tundra, temperate forest, grassy steppe, arid desert, moist savanna and wet jungle, each of great extent, there exist characteristic associations of animals. The nearly level expanses of northern Asia possess throughout a fairly uniform fauna, which, in many respects, is similar to that of Europe. But for most animals the broad deserts and lofty mountains intervening at the south present insuperable barriers. In consequence the faunal realms in the north and in the south are widely different. North of the Himalayas the animals form a part of the Palearctic realm, while those found in India, Indo-China and the adjacent islands belong to the Oriental realm. However, in southern Arabia, which physically is a continuation of the Sahara, the fauna is chiefly African in character; in the Celebes and the islands lying east and south of them the animals are Australian rather than Asian.

Animals characteristic of arctic Asia are the polar

bear, arctic fox, reindeer, lemming, and ptarmigan. Among the larger animals found in the more central parts of the continent are the wild camel, wild horse, kiang, and yak, the roe-deer, musk-deer, the saiga antelope, argali, wild goats, and the snow leopard. The smaller carnivores include wolves, foxes, and also fur-bearers, such as the sable, mink, ermine and marten; representative rodents are the beaver, various hares, pikas, spermophiles, and jumping mice.

The Oriental realm, lying wholly within the tropics, south and east of the Himalaya mountains, contains a remarkable fauna, especially rich in large mammals. Of this region the tiger, Indian elephant and rhinoceros are typical. Here also are found the lion, leopard, and cheetah, the sun bear of India, the fruit-eating bear of Malaya, the racoon-like panda, the lynx, civet, binturong, ichneumon, hyena and jackal. Within this region occur five large bovine animals which are more or less domesticated, the gaur, gayal, banteng, humped ox and water buffalo. Among other hoofed animals are various deer, the chevrotains, the muntjac, the tapir and various wild swine. Both insect-eating and fruit-eating bats are numerous. Insectivores are well represented. The dugong, a large marine mammal, occurs in the Indian Ocean. The primates of the region include the orang-utan of Sumatra and Borneo, several gibbons, numerous Old World monkeys, chiefly langurs and macaques, and a few lemurs. Of the macaques one species ascends to 10,000 ft. in the Himalayas, two species extend into Manchuria and one is found in Japan.

The birds of northern Asia, which closely resemble those of Europe, contain only well developed groups characteristic of cool regions. Especially noteworthy are the true pheasants, comprising many birds of splendid plumage found wild only in northern Asia. In the Indian region bird life is exceedingly rich and varied, ranking second only to that of tropical America in diversity of form and brilliancy of plumage.

Though scantily represented in northern Asia, reptiles attain marked development in the Indian region in which occur the crocodile and gaviel, the giant python, the cobra and other venomous snakes, various agamis, geckoes and flying lizards.

The most valuable economic animals utilized by man are mainly of Asiatic origin. Among those first domesticated in Asia are the horse, Bactrian (two-humped) camel, reindeer, yak, humped ox or zebu, water buffalo, goat, pig, chicken, carp, silkworm, and honeybee and probably also the sheep and the ox.

**Political Divisions.** Territorially and in terms of population, by far the largest independent country in Asia is China. This includes, with the dependencies of Tibet and Mongolia, approximately 4,300,000 sq. mi., or 25% of all Asia, and 480,000,000 people, or 48% of the inhabitants of Asia. The second most populous independent country is the Japanese Empire, with a population of roughly 90,000,000 and an

area of 260,700 sq. mi., or 9% of the people and 1.5% of the area of Asia. India, nearly all under British domination, has approximately 320,000,000 people living in 1,805,000 sq. mi. of territory, or 32% of the people and 10.5% of the area. The Asiatic part of the Union of Socialist Soviet Republics occupies approximately 5,000,000 sq. mi., with a population of roughly 25,000,000 people. Three other countries in Asia have considerably more area but much less population than the Japanese Empire. These are: Arabia, 1,200,000 sq. mi., 7,000,000 population; Persia, 628,000 sq. mi., 10,000,000 population; and Turkey, 283,000 sq. mi. (of which 8,200 are in Europe), 13,600,000 population. The smallest independent country in Asia is Bhutan, on the northern border of India, with an area of 20,000 sq. mi. and a population of 300,000.

**Religions.** Asia is the home of the world's leading religions. **BUDDHISM** started in India, but now has largely disappeared from that country and has spread to China, Japan and many of the smaller countries. Christianity predominates in northwestern Asia, and has followers in China, India, Japan and the other countries. **MOHAMMEDANISM** is the religion of southwestern Asia. **HINDUISM** in its various sects is India's chief religion. **TAOISM**, native to China, and **SHINTOISM**, native to Japan, are confined to these countries. **CONFUCIANISM**, the ethical system of China, has few adherents except among the Chinese.

**Population.** Asia has an estimated population of something over 1,000,000,000, or more than half the population of the earth. Nearly 90% of the people of Asia live in the three countries of China, 480,000,000, India, 320,000,000, and the Japanese Empire, 90,000,000. The population is unevenly distributed. Vast stretches of desert, mountains and polar regions have very few inhabitants, while the fertile river plains, especially in the south, are crowded. Over two-thirds of the people belong to the Mongolian race. (*See MONGOL.*) These include the northern Mongoloids, such as the Finno-Tartar and Turki-Tartar peoples of northern and central Asia; the true Mongolian peoples of northern China and Mongolia; the primarily Mongol but somewhat mixed peoples of Chosen and Japan; the southern Mongoloids of central and southern China, Tibet, Burma, Siam and Annam. The inhabitants of India are chiefly of Aryan stock, with considerable intermixture of **DRAVIDIANS** and some Mongoloid; in India there are between 18- and 20,000,000 of pre-Aryan Dravidian and other peoples. The black races are represented by the negroid peoples of the southern Indian hill country, of parts of the Malay Peninsula and some of the neighboring islands; though these people are to be distinguished from the Negritos of the Malay Peninsula and the islands to the southeast of Asia. The Malay peoples form an important independent and mixed element in southeastern Asia and the neighboring islands. The white races are represented in the Semitic peoples of Syria and Arabia, the numerous tribes of the Caucasus,

the Slavonic peoples in Siberia and the Aryan peoples of Iran and northern India.

Recent investigations and discoveries have pointed to the central Asiatic plateau as probably the center of origin and dispersion of the human race.

For the history of Asia see the different countries.

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**ASIAGO, BATTLE OF**, an engagement of the WORLD WAR during the Austrian offensive of May 1916, which took place on the plateau surrounding the town of Asiago, Italy, 15 miles north of Vicenza. The action aimed at severing the Italian line of communications with the Julian sector. Conrad von Hötendorff arranged his forces in two armies, proposing to strike at Vicenza and Bassano through the Arsiero and Asiago uplands. Simultaneously additional Austrian troops were to attack in the Lagarina and Sugana valleys. The Austrian forces totaled 180 battalions, supported by 2,000 guns of heavy and medium caliber. The Italian effective strength was estimated at 130 battalions and 850 guns. Though the Italians were dislodged on May 15 from strong positions, through ill-advised delay on the part of the Archduke Charles Gen. Cadorna was able to launch an effective counter offensive. Austrian casualties were 100,000; the Italians killed and wounded, about 110,000.

**ASIA MINOR** or **ANATOLIA**, the name given to the western peninsula of Asia, forming the greater part of the Turkish Republic. The local name for this territory is Anatolia, the term Asia Minor having neither official nor political sanction. Its situation at the extreme west of the Asiatic continent has tended to distinguish it as a little, or lesser, Asia; hence the wide prevalence of the loose geographical designation of Asia Minor. It is bounded on the north by the Black Sea, on the south by the Mediterranean, on the east roughly by Armenia and Persia, and on the west by the Ægean Sea. The interior forms a series of rising tablelands, with a maximum height of 4,000 ft. These plateaus consist mainly of bleak steppes, salt plains, marshes and lakes. Mountain ranges lie to the north and south, rising respectively to 6,000 and 12,000 ft. The chief rivers are the Kizil Irmak, the Yeshil Irmak, and the Sakaria, all of which flow into the Black Sea; and both the Sarabat and the Menderes Chai flow into the Ægean. The chief cities are Angora, Smyrna, Broussa, Adana and Trebizond. The climate resembles that of southern Europe, but wide variations occur in four different regions. The vegetation on both the northern and western coasts is magnificent. Area, 220,000 sq. mi. Pop. 1927, about 12,000,000.

**ASK** or **ASKR**, in Scandinavian mythology, the first man created by the gods. Embla was the first woman. Their home was called *Midgard*, the earth. *Ask* means ash and *Embla*, elm. The story is that the gods ODIN, HOENIR and LODUR found them wandering over the earth without purpose and gave them spirit, sense, color and blood.

**ASMA'I** (c. 740-c. 830), Arabian writer and scholar, whose full name was Abu Saïd Abd al-Malik ibn Kuraib Asma'i, was born in Basra, about 740. Extant among his many literary works are the *Book of Distinction*, *Book of the Wild Animals* and *Book of the Horse*. Asma'i spent most of his life at Bagdad, but died at his native Basra, about 830.

**ASNIÈRES**, a northwestern suburb of Paris, in the department of Seine, situated on the left bank of the Seine. Boats and perfumes are the principal manufactures. Pop. 1931, 63,654.

**ASOKA** (c. 264-227 B.C.), Emperor of India. Asoka stands, particularly in the opinion of the Buddhists, as one of the very great figures of Oriental history. His grandfather founded the Naurya Dynasty in India, and Asoka extended the borders of this rule to include the territory covering most of what is now British India. Particularly in the latter years of his life, Asoka became greatly attached to BUDDHISM and contributed large sums to the establishment of Buddhist monasteries and to the spread of Buddhist religion. He left many inscriptions in various parts of the country testifying to his Buddhist faith. The third great council of Buddhist leaders which resulted in the reformation of Buddhism and the establishment of the Mahayana salvation doctrine was held under Asoka's auspices.

**ASOLO**, a small town and commune in north central Italy, situated on a hill 10 mi. east of Bassano. ROBERT BROWNING lived here, in a street now named after the poet, and made Asolo the scene of *Pippa Passes*. Asolo was the retreat, after her abdication, of the last Queen of Cyprus, Caterina Cornaro (1454-1510), who held a brilliant court here. In the parish church there is an altarpiece by Lorenzo Lotto. Pop. 1931, 10,209.

**ASP**, a name popularly given to several species of poisonous snakes. It belongs properly to the horned asp (*Vipera aspis*) found in southern Europe, especially in the Alps region, and extending as far north as Sweden. This snake resembles the adder or common European viper, to which it is nearly related. In common usage and in literature the name "asp" has been applied most frequently to the deadly Egyptian cobra (*Naja haje*) which is similar to its well-known Indian cousin, except that it has no spectacler markings on the hood. The asp with which Cleopatra is supposed to have killed herself is not, however, thought to have been this cobra. It was probably the African horned viper (*Cerastes cornutus*), which is also extremely poisonous.

**ASPADAN** or **ISFAHAN**, capital of the Persian province of the same name, about 225 mi. south of Tehran, with many old buildings and mosques,

including the most splendid in Persia, the Masjid-i-shah, or royal mosque. Aspadan has active trade and diversified local industry. It passed through the hands of the Ptolemies, Arabs, Persians, Afghans and Turks, and was one of the richest cities of the Orient. In the past it was a world trading place with half a million inhabitants. Est. pop. 1930, 100,000.

**ASPARAGINE**, a crystalline substance,  $\text{CO}_2\text{H} \cdot \text{CH}(\text{NH}_2) \cdot \text{CH}_2\text{CO} \cdot \text{NH}_2$ , found in asparagus and also in various plants belonging to the mustard and pea families. It belongs to the group of amino-acids, being both a base and an acid, and plays an important part in plant physiology. It occurs as a product of decomposition of protein and may be obtained by filtration and evaporation of the juices.

**ASPARAGUS**, a genus of herbaceous perennials, woody shrubs and vines of the lily family, all natives of the Old World. Of the 150 species about a score are grown for ornament. The most important, however, is *A. officinalis* which has been grown in gardens as a vegetable since before the Christian era. The succulent young shoots develop from subterranean woody crowns with long fleshy roots and are preferably cut while short. As the stems mature they become feathery-branched, often 6 ft. tall and ornamental. Beneath the scales, which hug the stems, short leaf-like branches develop and function as leaves.

#### ASPARAGUS, COMMERCIAL PRODUCTION, U.S.

4-Year Average, 1927-30

Division	Acreage	Production (Crates)	% of Tot. Prod.
UNITED STATES .....	46,460	3,912,000	100.0
LEADING STATES:			
Early—			
California .....	10,545	1,528,000	39.1
Late—			
New Jersey .....	10,000	860,000	22.0
Illinois .....	3,878	218,000	5.6
Maryland .....	2,150	217,000	5.6

To produce choicest stalks, an inch or more in diameter, warm, friable soil rich in decaying vegetable matter, an eastern or a southern exposure, ample space between plants, annual, lavish feeding, particularly with manures and fertilizers rich in potash and nitrogen, and good tillage are essential. Only strong, one-year plants should be used for planting. In commercial fields plants are set 6 to 10 in. deep, 2 ft. asunder in rows 3 to 4 ft. apart; in gardens the depth should not be reduced but the distance between plants and rows may be as little as one foot each way. No stalks should be cut until the third year. Asparagus beds often continue productive for 30 to 50 years.

M. G. K.

**ASPARAGUS BEETLE**, a small blue-black beetle (*Crioceris asparagi*) of the family *Chrysomelidae*. The worst pest of asparagus. Wings of adults have yellow patches and reddish borders. Adults hibernate, emerging in spring when asparagus is being marketed. Eggs are attached by one end to stems of the host plant. Larvæ are grayish-black, soft-bodied creatures which feed on stems and leaves.

Pupation takes place in the soil. Two or four broods may occur each year. Insect enemies help to hold this pest in check. Many adults are winter-killed. Arsenical sprays, pyrethrum and nicotine with pencol are recommended as control measures. A closely-allied species, the twelve-spotted asparagus beetle, also feeds on asparagus, but is not a serious pest.

**ASPARAGUS-FERN** (*Asparagus plumosus*), a tall climbing plant of the lily family, native to South Africa, numerous varieties of which are grown by florists for decoration. Its conspicuous characteristic is the fine branching of the smooth green stem into very delicate, feathery sprays. As in the closely related garden ASPARAGUS, the true leaves are represented by small scales.

**ASPASIA** (5th century B.C.), one of the most famous women of ancient Greece, was born at Miletus, Ionia, the daughter of Axiochus. She came to Athens and, after forming an attachment with PERICLES, the celebrated statesman, became prominent in the intellectual and artistic circles of the city. Her wit, beauty and charm aroused jealousy, and she was at one time released from a charge of impiety only through Pericles's intervention. After the death of the statesman, Aspasia married a cattle dealer. She died at Athens.

**ASPECT**, a category of the verb which indicates whether its action is continuous and in process of completion ("imperfective, durative" aspect) or instantaneous and complete in itself ("perfective, momentary" aspect), as distinct from TENSE or time of action, "English I talk," for example, expressing imperfective action as contrasted with the perfective "I say." Aspect is characteristic of Semitic, Caucasian, Finno-Ugric, Indo-Iranian, Baltic, Slavic, and Greek, as tense is of Italic, Celtic, Germanic and Romance (see separate articles on these subjects); and it seems to have been the more primitive of the two, though concepts of time, relatively expressed, are found in the earliest periods.

The distribution of imperfective and perfective may be illustrated by the "tenses" of the Greek verb *leipō*, which may be either imperfective ("I am leaving") or perfective ("I leave once and for all"):

#### Imperfective

Present *leipō* (I am leaving)

Imperfect *eleipon* (I was leaving)

#### Perfective

Present *leipō* (I leave once and for all)

Aorist *elipon* (I left once and for all)

Perfect *leloipa* (I am now in the state of having left)

Aspect accounts for such instances of "suppletion" as Latin *fero, tuli*, or English *go, went*, where the present is imperfective, but the past (aorist or perfect) is perfective.

There are several other types of aspect, as inchoatives, iteratives, terminatives, etc.; an imperfective verb may be changed into a perfective, as by compounding

it with a preposition, e.g., Latin *conficio* "I finish" as contrasted with *facio* "I make"; and special forms may be created to meet a continuing sense of need for the expression of aspect such as English "I am saying" (imperfective) as contrasted with "I say" (perfective).

L. H. G.

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**ASPEN**, the name given to certain species of *Poplar* with tremulous foliage. The American aspen (*Populus tremuloides*), called also quaking asp, is distributed over a wider area than any other American tree. It grows from Labrador to the mouth of the Mackenzie River in the Arctic Ocean and throughout the valley of Yukon. Thence it extends southward to Pennsylvania and Nebraska and in the Rocky Mountains and the Sierra Nevada to Mexico. Although commonly a small tree, it sometimes grows 100 ft. high with a trunk diameter of 3 ft.; the wood is utilized chiefly for fuel and wood pulp. The aspen and the black willow (*Salix nigra*) are the only two native North American trees which extend across the continent from Maine to California. The similar European aspen (*P. tremula*) is common in forests throughout northern Europe and in Asia it extends northward to the Arctic circle. The light, soft but tough wood is used for making pails, pack saddles and numerous other articles. These two aspens in the northernmost parts of their range almost completely encircle the globe.

**ASPERGES**, the Catholic ceremony of sprinkling the congregation with holy water before the high Mass on Sunday. The practice dates from the 10th century and is so called from the Latin word *asperges* which opens the seventh verse of Psalm 51: "Purge me with hyssop and I shall be clean," a sentence recited, except in Easter Week, during the rite.

**ASPHALT**, or asphaltum, the solid or semi-solid **BITUMENS**, native or derived from **PETROLEUM**, used especially in paving, roofing and for other purposes. Under this term are included several bitumens similar to true asphalt, and used for much the same purpose, such as gilsonite and grahamite. When exposed to the atmosphere, oxidation and evaporation change the more fluid asphalts to solids. The composition of these bitumens is not chemically definite, because they contain a mixture of hydrocarbons and derivatives therefrom. The classes of compounds present are light and heavy oils, resins, black and brown pitch-like solids and nitrogenous compounds. Asphalt melts at about 100 degrees.

Organic remains, from low orders of plants and animals, accumulated in sedimentary beds in past ages and, by a slow process of natural distillation, produced oil and gas. The residues from this distillation form natural bitumens, including asphalt. They are not peculiar to rocks of any particular age. Asphalt is found impregnating shales, limestones and sandstones, and occasionally in seams traversing them; but commercial production comes from surface deposits. In ancient times it was mined in the Dead Sea region.

The famous present-day Trinidad Island asphalt, like the Venezuela deposits, consists of a pitch lake, nearly circular, which covers an area of about 100 acres. Near the center it is liquid, but the borders are solid enough to support vegetation. The solid material is excavated for industrial use. In the United States, Kentucky, Texas, Utah, Colorado, Oklahoma and California produce asphalt which, with the large tonnage manufactured from petroleum, is used for paving and to make paints, varnishes, prepared roofing, insulation and rubber substitutes. Perfectly preserved remains of extinct animals such as the saber-toothed tiger have been recovered from the Rancho la Brea asphalt pools, near Los Angeles, Calif. See also **BITUMINOUS MATERIALS**.

S. F. K.

**ASPHALT BLOCK PAVEMENT**. See **ASPHALT PAVING**.

**ASPHALT PAVING**, a highway wearing surface in which mineral **AGGREGATES** are coated with a thin film of **ASPHALT**, cementing them together. Sheet Asphalt consists of about 75% sand, chats, or other minerals varying in size from 1/8 in. to 1/200 in., about 15% fine dust and about 10% asphalt. Materials are heated to about 350° F., mixed thoroughly at an asphalt plant, hauled to the work, raked level and rolled, while hot, with a six to ten-ton roller. It may be laid directly on a concrete base, but often on a levelling, open, porous, "binder course" of bituminous concrete. Asphaltic concrete consisting either of: (1) A sheet asphalt in which there is incorporated 30 to 50% crushed stone one inch and less in size, or (2) of a true asphaltic concrete consisting of graded stone two inch and smaller, with just enough sand or screenings to fill the voids, a small amount of dust, and enough asphalt to coat all particles. These are known as "blacktop" or "sheet" pavements. The asphalt is varied in consistency to suit prevailing temperatures and expected density of traffic—hard asphalts in the south or under heavy traffic, and softer grades in colder climates or for light service. See **ASPHALT TESTING**.

Asphaltic mixtures are also compressed into asphalt blocks which are hand-set like brick to make a pavement.

Some sandstones and limestones occur naturally impregnated with asphalt. When quarried and crushed they may be laid like sheet asphalt. Rock asphalt, from deposits of sandstone occurring in Kentucky, can be laid cold. Deposits found in Texas, Oklahoma, Missouri, Alabama and in Sicily and Switzerland usually require the addition of some light asphalt "flux" and are sometimes heated before laying. Such asphalt pavement surfaces are laid on **PAVEMENT BASES** of **PORTLAND CEMENT** concrete, sometimes of bituminous concrete or on old **MACADAM** Roads or streets. See also **BITUMINOUS MACADAM**; **SURFACE TREATMENT**.

W. W. H.

**ASPHALT TESTING**, generally comprises the following tests:

**Bitumen Content**. One gram of asphalt is dissolved in **CARBON BISULPHIDE**. The liquid is passed through an asbestos filter and the amount of material

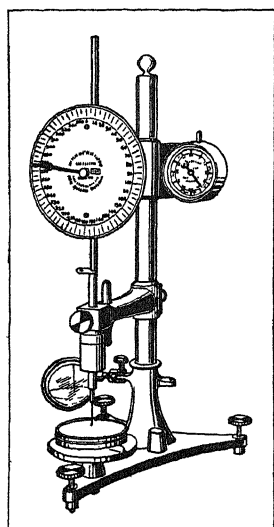


caught on the filter is weighed. The difference, or the amount soluble, is by definition BITUMEN and is so reported. See also BITUMEN EXTRACTION TESTS.

**Asphaltene Content.** Asphaltenes are defined as bitumen insoluble in paraffin NAPHTHA, and in making the test any material insoluble in carbon bisulphide is considered as being insoluble in paraffin naphtha. The bitumen content is first determined and then a sample is dissolved in paraffin naphtha. From the two values obtained the asphaltene content is calculated.

**Carbenes.** Carbenes are defined as bitumen insoluble in carbon tetrachloride. The procedure is identical with that for asphaltenes, except for the solvent.

**Specific Viscosity** is determined with the Engler viscosimeter, which compares the rate of flow of the bituminous material with the rate of flow of water at 25° C. through a standardized orifice. The charge in the viscosimeter is 240 cc. and the amount run out is 50 cc. The usual temperatures are 40° C., 60° C., and 100° C. The Viscosity is the time for the bituminous material divided by the time for the water.



COURTESY EIMER & AMEND  
PENETROMETER USED IN ASPHALT PENETRATION TEST

**Penetration Test.** The consistency of asphalts is measured by the penetration of a standardized needle into a sample. Normal conditions of testing are that the sample shall be at a temperature of 25° C., the load on the needle, 100 grams, and the time of application of the load, 5 seconds. The penetration value is the number of

hundredths of a centimeter the needle penetrates.

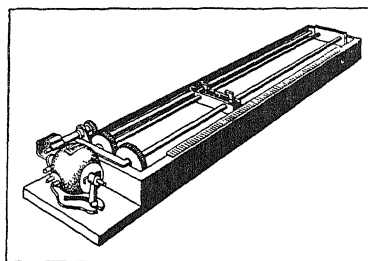
**Loss on Heating.** An idea of the amount of volatile compounds present may be secured by heating a 50-gram sample for 5 hours at a temperature of 163° C. The percentage loss in weight is figured on the basis of the original weight.

**Flash and Fire Points.** The flash and fire point temperatures of an asphalt are determined by heating a selected sample in a "Cleveland" open cup tester at a given rate and at regular intervals applying a small flame. The *flash* point temperature is taken when there is a distinct flicker over the entire surface of the asphalt, and the *fire* point temperature when enough volatile materials are being driven off to burn continuously.

**Ductility.** The ability of an asphalt to change shape without breaking is measured in this test, in which a briquet with a cross-sectional area of 1 sq. cm. at the midpoint is pulled apart. The usual temperature is 25° C. The ductility value is the number of centimeters stretched before the break occurs.

**Residue at Specified Penetration.** The asphaltic content of liquid asphalts is determined by heating between 249° C. and 260° C. a 100-gram sample in a special apparatus until the residue has a penetration of 100 in the "penetration" test.

**Specific Gravity.** Specific gravity of asphalts is determined at 25° C. and may be done variously as follows: (1) Allow hydrometer to come to rest in liquid asphalt and read specific gravity on the scale;



COURTESY EIMER & AMEND  
MACHINE FOR TESTING DUCTILITY OF BITUMINOUS PAVING CEMENTS AND BINDERS

(2) weigh a piece of solid asphalt in air and again immersed in water and compute the specific gravity from these weights; (3) or determine the volume of a known weight of asphalt in the Hubbard-Carmick specific gravity bottle. E. E. B.

**ASPHERICAL.** See LENSES.

**ASPHODEL**, a small genus (*Asphodelus*) of annual and perennial herbs of the lily family, natives chiefly of Mediterranean countries, several of which are planted for ornament. They are trunkless plants with a clump of narrow root leaves and a flower-stalk bearing attractive white flowers in showy clusters. Among the best known is the white asphodel (*A. albus*) with flower-stalks 3 to 4 ft. tall. The name is applied also to various related plants as the yellow asphodel (*Asphodeline lutea*), the asphodel of the ancients. Early English and French poets applied the name to the daffodil. By some the asphodel of Greek writers is believed to be the poet's narcissus (*Narcissus poeticus*).

**ASPHYXIA**, the condition resulting from deprivation of oxygen. It occurs in two general ways which induce two somewhat different results:

(1) When breathing is prevented, by obstruction in the windpipe, by strangling or by drowning, the supply of oxygen to the lungs is stopped, as is also the elimination of carbon dioxide; and the circulation of the blood through the lungs is also impeded or stopped. The victim struggles violently, and soon dies. This type of asphyxia is best called suffocation.

(2) On the other hand, when there is no mechanical interference with breathing, but when the air inhaled contains an insufficient amount of oxygen to support life, the circulation of the blood through the lungs is at first accelerated. There is vigorous breathing which produces an excessive blowing off of carbon dioxide, so that the body's store of this substance, normally

considerable, is seriously decreased. To ANOXEMIA, or deficiency of oxygen in the blood, there is thus also added acapnia, or deficiency of carbon dioxide. The effects of such deprivation of oxygen are at first chiefly the expression of derangement of the nervous system and finally of the heart.

When a normal man breathes air in which the oxygen is gradually decreased, there is after a time an increase in the volume of breathing. This is an important feature in acclimatization to altitude. On exertion, the breathing is proportionally more at high altitudes than at sea level. A person ascending to an unusual altitude is liable to suffer from mountain sickness, which is one of the first stages of asphyxia. It is characterized by headache, unreasonable temper, nausea and vomiting, and muscular weakness. Similar effects, resulting in mental confusion and then in unconsciousness, occur in aviators who make ascents to great heights without oxygen apparatus.

When a man is suddenly exposed to an atmosphere extremely deficient in oxygen, he falls unconscious almost instantly, and, unless rescued, he dies in a few minutes. This occurs in places where the oxygen of the air has been absorbed by chemical action, or where the air is mixed with inert gases.

The stages of asphyxia are as follows: When the oxygen in the air is reduced from the normal 21 to 16%, a candle is extinguished but a man is not considerably affected. At 12% of oxygen a man feels no discomfort, or other sensation to warn him of his danger, but his breathing and pulse are increased; muscular exertion is difficult, judgment is diminished, and the mind confused. When the oxygen is reduced to between 6 and 9%, unconsciousness comes on. Under lower pressures death soon occurs. If the patient is removed even after deep asphyxia, he generally recovers completely in a few days; but in many cases pneumonia develops.

The commonest cause of asphyxia is the carbon monoxide contained in illuminating gas, in the exhaust gas of automobiles, and in the fumes from stoves operating with an insufficient supply of air (see GASES AND ATMOSPHERES, INJURIOUS).

The treatment consists in the administration of an artificial inhalation of oxygen mixed with 7% carbon dioxide. If breathing has stopped, ARTIFICIAL RESPIRATION is resorted to until natural breathing recommences. In this inhalational treatment, the carbon dioxide acts as a stimulant to breathing, and the oxygen assists in displacing carbon monoxide from the blood.

Y. H.

**ASPIDISTRA**, a genus of perennial plants of the lily family comprising about six species native to eastern Asia, one of which is widely grown for its ornamental foliage. They are stemless plants rising from strong rootstocks with large, vigorous, root leaves and brownish flowers, an inch across, borne singly at the surface of the ground. The common aspidistra (*A. elatior*) bears stiff, evergreen, strongly veined leaves, 1 to 2½ ft. high and 3 to 4 in. broad. It thrives in the open in Florida, especially when planted near

flowing water; in cool climates it is extensively grown as a pot and window-garden ornamental. Because of its ability to endure rough usage it is sometimes called cast-iron plant.

**ASPIDIUM**, a botanical name formerly given to a large genus of true ferns embracing several hundred species most numerous in tropical regions. Botanical authorities now apply the name *Dryopteris* or *Thelypteris* to this large group, which includes some of the most handsome woodland ferns of temperate regions.

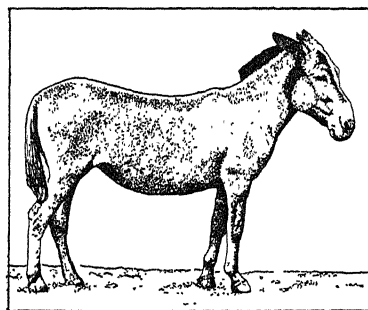
The drug aspidium, extracted from the rhizomes and stipes of the male fern (*Aspidium*, or *Dryopteris*, *Filix-mas*), is administered in the form of an oleo-resin as a remedy for expelling the common tapeworm. See also DRYOPTERIS; THELYPTERIS.

**ASPIRATORS.** See VACUUM.

**ASPIRIN.** See ACETYL-SALICYLIC ACID.

**ASQUITH, HERBERT HENRY** (1852-1928), British statesman, was born at Morley, Yorkshire, Sept. 12, 1852. He studied at Balliol College, Oxford, and in 1876 was admitted to the bar. In 1886 he entered Parliament and used his exceptional ability in debating and speaking for the Liberal party. He became chancellor of the exchequer in 1905 and in 1908 prime minister. The Irish Home Rule Bill was passed in 1914 during his tenure of this office. The next year, to meet war conditions, he formed a coalition cabinet but in 1916 his ministry ended when Lloyd George was given practical dictatorship. Asquith was the author of *The Genesis of the War* and other works. He died at London, Feb. 15, 1928.

**ASS, WILD**, an animal of the genus *Equus*, related to the horse and zebra. It differs from the horse in the relative shortness of the hair on neck and tail, in the absence of callosities on the hind legs, and in having longer ears. Of the five known species two



AFRICAN WILD ASS  
From Masai, Kenya Colony

are African and three Asiatic. The most interesting and typical is the Nubian wild ass, believed to be the parent wild species of the domestic races, as donkeys. It stands about 55 in. high, has in addition to the spinal black line, a dark "cross-line" over the shoulders and indistinct rings on the legs, marks occasionally noticeable in donkeys. Its habitat is the stony desert between the Nile and the Red Sea. Hunters describe this swift courser of the desert as reddish-cream in color and showing "the perfection

of activity and courage." The wild ass of Syria closely resembles the Nubian, and is occasionally tamed. Almost identical with it is the sand-colored kulan or onager of the plains of Persia, the Punjab and Turkestan. A fifth sort, the kiang or dziggetai, is confined to the Tibetan tableland, where it has acquired a more furry coat and darker hue than its southern cousins. E. I.

**ASSAM**, a province in the northeast extremity of British India, bordering on Bengal, Burma, Tibet and Bhutan. Area 53,015 sq. mi. The province is mainly in the Brahmaputra or Assam Valley, which from its western end where it is closed round by mountains, is about 500 mi. long with an average breadth of about 50 mi. The Brahmaputra River is broad here and divides and reunites again in many places. Rice is grown on the flat alluvial lands of the valley, and tea on the gentle slopes where the drainage is good. Most of the valley has a rainfall of over 80 in. a year, but the center is a little drier. Cloudy skies and fogs help to temper the excessive heat of the hot season. In some of the hills the monsoon rains are about the heaviest in the world (Cherrapunji has over 500 in. annually), and the low-lying regions suffer from inundations. The jungle produces valuable teak, cedar and bamboo, and shelters elephants, tigers, rhinoceroses, leopards, buffaloes and bears. Jute and silk are important products in the valley. There are two small oilfields and a small coalfield. The tea plantations supply more than half of India's annual crop. Large numbers of natives from BIHAR are employed as coolies in the tea gardens. The principal native races are of the Shan stock. In 1839 the entire province was placed under British administration. The population, including the feudatory states, 1921, 7,606,230; 1931, 8,784,943.

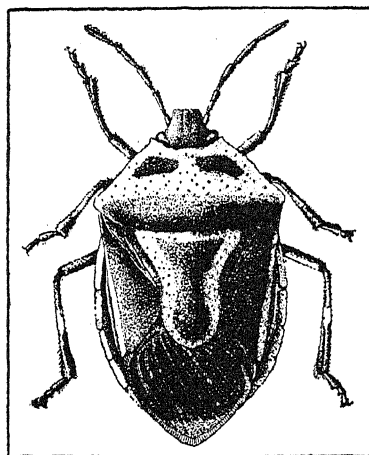
**ASSAROTTI, OTTAVIO GIOVANNI BAT-TISTA** (1753-1829), Italian teacher and founder of school for deaf-mutes, was born at Genoa in 1753. His interest in Abbé Sicard's work with deaf-mutes in Paris led him to found a small school in Italy which Napoleon aided with funds and buildings. Assarotti died in 1829.

**ASSASSIN BUG**, a predatory bug of the family *Reduviidae*, of which more than 100 species are found in the United States. The assassin bug has a long, sharp beak with which it pierces other insects and sucks their blood. One species, *Conorhinus personatus*, found in the southwest, is a fierce biter, with a beak strong enough to pierce the skins of human beings. Another species, *Reduvius sanguisuga*, is found in the northern states, where it lives in cellars, preying on bedbugs and cockroaches.

**ASSASSINS, ORDER OF**. The word assassin is probably derived from *hashishiyun*, or taker of hashish, the opiate drawn out of hemp leaves. The order was founded by Hasan Sabah on behalf of propaganda for the Fatimid caliphs of Cairo against the legitimate Sumni caliphs of Baghdad. In 1090-91 Hasan gained possession of the strong mountain fortress of Alamut, Persia. From this base he cap-

tured other hill forts in Persia and Syria, and carried on a campaign of assassination. Among its victims were the famous Salijuq Nizam al-Mulk (1092). The Crusaders encountered the Assassins in Syria, directed by their local "lord," or "sheikh of the mountain," and at times entered into friendly relations with them. The Persian strongholds of the order were destroyed in 1256 by Hulagu, the Mongol, and the forts of Syria fell in 1272 before the Mameluke sultan Baibars.

**ASSAULT AND BATTERY**. An assault is a threat to do violence to the person of another; battery is the actual hostile touching of the other's person. Mere words, no matter how provocative, do not constitute an assault. In case of a criminal prosecution for assault and battery specific intent to commit an aggression upon the person of another must be shown. A direct unlawful contact with the physical person of another although not an intentional aggression gave rise to an action of trespass at common law, and hence is often styled battery along with the wilful use of force or violence upon the person of another to which the term is more strictly applicable.



COURTESY U.S. DEPT. OF AGRIC.

DOUBLE-EYED ASSASSIN BUG  
(*Perillus bioculatus*). A predaceous enemy  
of the cucumber beetle (much enlarged)

**ASSAY**, the determination of the metallic content of a sample of ore. The result is expressed in percentage by weight, except in the case of precious metals, like gold, silver, and platinum, the contents of which are stated in troy ounces per ton of 2,000 avoirdupois pounds. Assay methods are broadly subdivided into two classes, dry assays and wet assays. The dry assays are used primarily for gold and silver, and sometimes lead determinations. The sample is melted in a special crucible with appropriate fluxes, including lead oxide or litharge when necessary. The iron and non-metallic elements go into a glass-like slag and the valuable metals collect in a lead button from which they are separated by further heat treatment. Wet assays are quantitative chemical analyses. See CHEMISTRY, ANALYTICAL; SAMPLING.

**ASSAY OFFICE**, a United States government bureau maintained for the purpose of ascertaining the value of precious metals by weight and fineness, according to standards set by the Federal government. The assay office may buy, sell, refine and test gold and silver, but all coinage is done at the government's mints located at Philadelphia, San Francisco and Denver. The assay office is part of the mint service of the Treasury department, and is located at New York City. All gold received from foreign countries in payment of trade balances is analyzed here. Branches of the assay office are located at Carson City, Nev.; New Orleans, La.; Seattle, Wash.; Helena, Mont.; Boise, Idaho; Deadwood, S.D., and Salt Lake City, Utah.

**ASSEMBLY**, the putting together of component parts that go to make up units or complete machines. It was formerly necessary to fit the parts together by filing, reaming or scraping, but modern manufacturing methods produce parts of sufficient accuracy so that they will go together without further fitting. Where an extremely accurate assembly is required, the parts are selected beforehand to insure the desired fit, this being known as "selective" assembly. See **PRODUCTION**, **INTERCHANGEABLE**.

Assembly methods vary with the quantity and quality of the work. In some cases the same man assembles the complete machine while in others the work may be so divided that one man only puts on a single nut as the machine passes his station on the "belt," or conveyor line. See **CONVEYING MACHINERY**. On some small work the conveyor brings the parts to the bench and carries away a complete unit, or machine.

The more accurately the parts have been made, the less time will be required in assembling them and the better they will function. Accurate inspection of parts during their fabrication prevents delay and reduces cost in the assembly, which in reality becomes the final inspection. In some products, such as airplane engines (see **AIRCRAFT ENGINES**), the engine is taken apart or disassembled after its running test, and each part examined to note wear or flaws that may have developed. The parts are then cleaned and the engine reassembled ready for delivery. This is not common practice, however, on small or medium sized machines.

Large machines, such as **PRINTING PRESSES**, must in most cases be disassembled after testing in order to ship them to their destination. The modern plant making this kind of machinery assembles and tests each unit of the machine before the final assembly of the completed machine. It is then tested and disassembled for shipment, the reassembly being in the plant in which it is to be used. This method is also necessary with all large machinery. **F. H. C.**

**ASSEMBLY, RIGHT OF**, is guaranteed not only by the first amendment to the Constitution of the United States but also by the constitutions of 45 of the 48 states. Together with the right of petition, free speech and a free press, it constitutes, in the opinion of one school of political thought, an inalien-

able right and the very foundation of democratic government. The constitutional guarantee by no means extends to all assemblies under all conditions, however. Not only may the authorities constitutionally disperse any assembly gathered together for the commission of a crime, but they may also make reasonable regulations for the holding of peaceable meetings. A gathering on the public streets may be prohibited in the interests of traffic; one in a private house, by virtue of fire hazards. Whether in times of unrest the municipal authorities always confine their discretion to constitutional ends is perhaps a moot question.

**BIBLIOGRAPHY.**—J. P. Bishop, *Criminal Law*, 1892.

**ASSEMBLY, UNLAWFUL**, a gathering of three or more persons, with intent to commit an act forbidden by law. This is substantially the **COMMON LAW**, which is generally the same in the **STATUTES**. The New York penal code provides that if three or more persons being assembled, attempt or threaten any act "tending towards a breach of peace, or an injury to person or property, or any unlawful act" it is an unlawful assembly. Persons who join in an unlawful assembly, are considered as liable as the original offenders.

**ASSEN**, capital of the province of Drenthe, Holland, a railroad center, situated on the Drenthe-Hoofd Canal to Meppel. Assen has schools, a museum of antiquities and its inhabitants pursue agriculture, trade and peat-cutting. In the neighborhood are prehistoric graves built of enormous blocks of stone, which were once covered with earth. Pop. 1926, 17,900.

**ASSESSED VALUE**, an expression denoting the valuation upon which a tax is to be computed, expressed in terms of money. It is most frequently used in connection with the taxation of property, but it is, in reality, appropriate to the levy of any tax that is computed on the value of the taxable object. Different values are used for assessed value, such as full value, fair value, cash value, true value in money and so on. However, the popular and practically universal definition of value, for taxation purposes, is the price that would be paid in a voluntary transaction between a willing buyer and a willing seller. Assessed values are fixed at some percentage of the full value and in a few states the legal basis of assessment is a percentage. Since full value must be determined by the assessor before the percentage can be properly computed, the advantage of the reduced basis is largely illusory.

In the case of ordinary holdings and forms of property market prices usually serve as a guide for the assessor, but no market quotations are available on some types of property. There is no active market for steel mills, railroad systems, skyscrapers or similar large aggregates. The assessed value of such properties must be determined, therefore, by an exercise of judgment based upon consideration of numerous factors, such as the earning power, the cost of reproduction, the business prospects of the near future and

the records of past years. Even in the case of ordinary properties, market prices may not always be readily available or clearly indicative of the range of values. The determination of equitable assessed values in such cases is greatly facilitated by the use of an assessment procedure capable of uniform application. For urban lands and buildings, such a procedure has been developed and is in fairly general use. It employs the front foot as the unit for land measure, and determines unit value by reference to sales and by conference with real estate owners and dealers.

Uniformity of assessment is achieved by smoothing out the gradation of unit values until they correspond acceptably to the community opinion regarding the variation in land values over the district. The computation of the values of individual parcels after unit values have been fixed involves the application of rules for depths greater or less than the standard, and for irregular shapes. The valuation of buildings requires the establishment of standard factors of value for different types and for different construction materials. An essential feature of building assessment is the depreciation schedule. The assessed values of the several items and classes of property, as fixed by the assessors, are usually reviewed and equalized by local and state boards of equalization before being finally confirmed as the basis of the tax levies. See also *BOOK VALUE*. H. L. L.

**BIBLIOGRAPHY.**—Cuthbert E. Reeves, *The Appraisal of Urban Lands and Buildings*, 1928; John A. Zangerle, *Unit Value Land Maps with Building Schedules and Photographic Types*, 1924.

**ASSETS**, of a business, all its properties owned, either legally or equitably. Some properties to which the business has not at a given time acquired legal title must nevertheless be equitably shown among its assets. Thus, merchandise ordered and in transit at the end of the fiscal period is best considered an asset of the buyer even though title has not yet passed. Similarly, real estate used as collateral security for mortgage notes payable, though title legally vests in the lender—under a clause of defeasance which reinvests title in the borrower upon the fulfillment of his loan contract—is always shown among the assets of the mortgagor or borrower. The root meaning of the word, assets, is sufficiency, because under normal conditions such properties are presumed to be sufficient to meet all the claims of creditors.

Assets are classified as current, fixed, or other. **CURRENT ASSETS** are those which in the normal course of trade will be converted into **CASH**. With a part of the original cash capital invested a stock of merchandise is purchased for trading. As the merchandise is sold, claims against customers arise which upon collection are converted into cash, thus completing the trading cycle from cash through merchandise and receivables back again to cash. All the assets used in and arising out of this trading cycle are normally classed as current assets. The **FIXED ASSETS** are those representing investments of **CAPITAL** to provide the facilitating properties used in carrying on the busi-

ness. Thus, the business plant—land and buildings—and its equipment, such as furniture and fixtures, machinery and tools; patents, franchises and goodwill; and **STOCKS** and **BONDS** held for long-term investment are the usual items of fixed assets. All assets not falling within these two classes are usually classified as other assets, among which are found those items which, while not to be classed as fixed, are yet too slow of realization in cash properly to be classed as current. Loans to officers and directors or advances to subsidiary companies are examples. R. B. K.

**ASSIDEANS**, also Hasideans, "the pious ones," a religious sect or party of the Jewish people which flourished from perhaps the 4th to the 1st century B.C., during the Hellenistic period of Jewish history. However, it was only during the period of the Maccabean wars against Antiochus IV of Syria, from 168 to 162 B.C., that the Assideans were important in the political life of the Jews. During these wars the Assideans were among the most ardent supporters of Judas Maccabeus, their aims being almost exclusively religious, not national. They joined Mattathias and his followers shortly after the beginning of the war, and seem to have soon become the most energetic force in the struggle waged by the Jews in behalf of their religious independence. Many of them preferred death to the violation of the dietary laws. On one occasion, when they refused to fight on the Sabbath Day, thousands of their men, women and children who had taken refuge in a cave near Jerusalem were slaughtered by the Syrian soldiers.

The Assideans were unusually strict in their observance of the Mosaic law, and were thoroughly hostile to the Hellenistic customs and practices which at that time were exerting increasing influence over a large part of the Jewish people. They hated also those Jews who were influenced by the spirit of Hellenism. They condemned as sins the luxuries and refinements in which the Jewish Hellenists found pleasure, and called the latter "breakers of the Law" and "transgressors of the Covenant." In contrast with the sect or party of the Sadduceans, who denied the validity of the Oral or traditional Law, the Assideans regarded the Oral Law as equally binding and authoritative. In addition, the Assideans are generally believed to have practiced a strict asceticism, although this assertion has been seriously disputed in recent years. It is further believed that the Assideans later merged with the **PHARISEES**, a sect or party which originated from its ranks; others, however, are of the opinion that the later **ESSENES** developed from the ranks of the Assideans. A. SH.

**BIBLIOGRAPHY.**—Graetz, *History of the Jews*, vol. 1, p. 436 (also index under Chasidim); Moritz Friedländer, *Die Geschichte der Jüdischen Apologetik*, p. 437 et seq.; Jost, *Geschichte des Judentums und Seiner Sekten*, vol. 1, p. 199.

**ASSIGNATS**, paper money issued following the French Revolution from 1789 to 1796 to take the place of metallic currency and designed to relieve the financial burden of new government. The acceptance of the Revolution was accompanied by an extreme

hostility toward the financial institutions of the ancient regime. Hence, the assignat, the most important single source and most elastic form of revenue, was an essential part of the Revolution. The governments manufactured paper money for the purpose of paying their servants at home, purchasing supplies at home and abroad, and supporting armies on all frontiers. Monetary theorists examining the history of this classic paper money in 1791-96 will find that the QUANTITY THEORY OF MONEY was vindicated, that the value of the assignat was maintained by land seized from the church and the emigrants, and that the proportion between internal and external values was not as close as might be desired. Political events were reflected in fluctuations in the value of the assignat. Declarations of war in 1792 and 1793, internal dissension, the defeat of the Terrorists were bearish factors; on the other hand, the assignat rose with the institution of a powerful government in 1793-94, the confiscation of new lands, and important military victories. But the endless creations proved the decisive factor, and the glorious victories of 1795-96 were wasted on the assignats; the immutable laws of mathematics won a decisive victory over strong and disreputable governments. S. E. H.

BIBLIOGRAPHY.—S. E. Harris, *The Assignats*.

**ASSIGNMENT**, the act of transferring to another a claim, right or interest, also used of the instrument or writing by which such a transfer is made. There may be a general assignment of all the debtor's property for the benefit of creditors, or an assignment of a particular instrument or particular claim or particular interest in specific property. At common law things in action, that is, claims which required to be sued upon in a court of law in order to make them effective, could not be transferred, and the assignment was effective only in equity. In such cases the assignee brought suit in the name of the assignor and equity recognized him as having a power of enforcement through using the assignor's name. To-day by legislation the assignee is generally regarded as having become the owner and is able to enforce it directly.

**ASSISI**, a city of Italy, situated in the central part of the peninsula, in the province of Perugia. It is the seat of a bishop. It was the ancient Umbrian *Asisium*, and became renowned through St. FRANCIS, founder of the Franciscan Order. The castellated monastery was built on the brow of a hill soon after the death of the saint. The double church contains St. Francis's tomb. The Lower Church was built 1228-32 and the Upper, 1253. In both churches frescoes by GIORRO are the main attraction. The small Chiesa Nova was built in 1615 on the site of the house where St. Francis was born, and his statue adorns the Piazza San Rufino in the upper city, where rises the medieval cathedral. Nearby is the Gothic church of Santa Chiara, 1257. Under the high altar rests the body of St. CLARA, an admirer of St. Francis and foundress of the Order of Poor Clares. The city has other fine churches, and Etruscan and Roman remains. Pop. 1931, 21,614.

**ASSIZE**, a type of statutory regulation, chiefly referring to prices, which existed in England from the 12th through the 18th century. The first assize was that of measures, in the reign of Richard I, which regulated WEIGHTS AND MEASURES throughout the realm. In 1202 the first assize of bread was made, which regulated the amount of bread to be sold for certain prices. The assize of bread was continued, though probably not enforced, through the 18th century. Similarly, there were assizes of ale, wool and other commodities. Although the assize was usually concerned with price regulation, there was the assize of buildings, in 1181, which regulated all the conditions of building in London after a fire. Many of the assizes were parliamentary, and therefore applicable to the whole kingdom. They were enforced by the local authorities, and, at the end of the 14th century, by JUSTICES OF THE PEACE. Local assizes also existed, meat being one of the commodities usually regulated by local authorities. The extent to which assizes were actually enforced is a controversial question. In the early years of their existence they were probably obeyed, but, by the 17th and 18th centuries, they apparently had little effect. E. W. G.

BIBLIOGRAPHY.—W. Cunningham, *Growth of English Industry and Commerce*.

**ASSOCIATED PRESS**, a cooperative news-gathering organization, chartered in 1900 as a non-profit-making corporation under the laws of New York. Its membership consists of persons representing more than 1,200 daily newspapers throughout the American continent. These members carry on a mutual exchange of the day's news. The association collects and distributes news from all parts of the world, employing special correspondents in most of the leading cities. Furthermore, it possesses contacts for news exchange with a number of foreign agencies. Geographical sections have been mapped out which receive Associated Press dispatches of value to their particular districts. Membership in the association is limited to a certain number in each city, depending upon the size of the latter. Maintenance expense is prorated among all the members.

**ASSOCIATION, CHEMICAL**, signifies a union of similar simple atoms or molecules to form a complex molecule; whereas *combination* denotes the joining of atoms of different elements into chemical compounds. Dissociation is the term applied to the reverse of both processes. Among gases, association is generally furthered by a decrease in temperature or an increase in pressure, and the process may sometimes be accompanied by a change in color, and its extent determined by a change in vapor density, the associated molecules being heavier and fewer in number than the unassociated ones. In a liquid, the association of its molecules cannot be directly determined by the density as in the case of gases, but must be conjectured from the boiling and freezing points. Thus, in the case of water, which has a very high boiling point for such a simple chemical constitution—H<sub>2</sub>O—it is thought that most of the liquid water



occurs as complex molecules of the composition  $(H_2O)_2$  and  $(H_2O)_3$ .

**ASSOCIATION, THE CONTINENTAL.** See CONTINENTAL CONGRESS.

**ASSOCIATIONALISM** explains the composition and sequence of mental phenomena by the principle of association. It was formulated by David Hartley (1705-57) and appears in his *Observations on Man*, begun in 1731, published in 1749.

The trend toward an empirical account of mental experience, perceptions, ideas and beliefs, appears in Hobbes, and was carried forward by Hume in part, and notably by Berkeley and Locke. Hume described association by resemblance, by contiguity in space and time, and by cause and effect. Repeated impressions developed to ideas and formed concepts. Berkeley, in his *New Theory of Vision*, studied minutely the relations or connections by which the mind built up association-wise, the notions of size and distance through the cooperations of sight and touch. Similarly the rumble of a coach combines with its appearance and use and makes the idea or concept of a coach a composite associational product.

Hartley sought the physiological basis of the process in vibrations in the nervous system; he took his clue from Newton's proof that rates of vibration determined the colors of the spectrum. He spoke of vibratuncles as diminutive physiological counterparts of ideas. Association occurs between sensations, ideas or movements; it is essentially a matter of contiguity. Similarity, called resemblance by Hume, and contrast, as already recognized by Aristotle, may be regarded as special variants of contiguity. There are both simultaneous and successive associations. The higher mental compounds arise synthetically by association of the simpler ones. The doctrine is applied to pleasures and pains associated with sensations and activities, as well as to intellectual meaning, or beliefs, and to moral qualities. Partial common components of different experiences may participate in an association, through a community of value or purpose as well as of content, meaning or appearance. Thus arise the rich fringes of ideas. The child begins without associations but with a capacity for sensory experiences, which gradually enlarges by endless connections and relations into a complex world of ideas, beliefs, and finally, systems of thought and principles of action.

The impetus thus given to the course of psychological doctrine by Hartley's associationalism became a permanent contribution. It opposed the nativistic doctrines of an older philosophy, which however persisted in the restatements of a faculty psychology.

The later development of the associationalism appears in James Mill's *Analysis of the Human Mind*, 1829. He fixed the term association of ideas as trains or sequences of thought of whatever range or composition, and noted the conditions of their relative strength, or vividness, and value or meaning. The doctrine was further elaborated and modernized by his son, John Stuart Mill, who made of it a form of mental chemistry. With the advent of the experi-

mental method as an instrument of analysis, and the recognition of the basic physiological support of mental processes, associationalism lost its special pertinence as a psychological principle. Associationalism may be regarded as an antecedent of the modern view which finds in the connections of the nervous system the favoring supports of behavior patterns. This is best presented in Thorndike's recent work. He speaks of this position as connectionism. Behavior is composed of specialized tendencies to response which are reinforced and modified by experience, which means change of behavior according to its consequences. Connectionism is the scientific formulation of the problem that shaped the associationalist approach.

J. J.

**BIBLIOGRAPHY.**—All the histories of psychology contain chapters on Associationalism. Warren's *History of the Association Psychology*, 1921, is comprehensive.

**ASSOCIATION OF IDEAS**, a theory which aims at an explanation of the way in which ideas are recalled. It is as old as ARISTOTLE, but came into prominence in connection with British associationist psychology. Although THOMAS HOBBS and JOHN LOCKE had made use of its principles, it was David Hartley (1704-57) who is generally regarded as the founder of the school. Priestley and James and John Stuart Mill are other representatives. Associationalism reached its height with ALEXANDER BAIN (1818-1903).

The fundamental principles recognized by Aristotle are those further developed by the associationists. They are three in number, viz., association by contiguity, by similarity and by contrast. When two ideas have occurred together, upon the presentation of the one the other will have a tendency to appear also. This is the principle of association by contiguity. Thus it is possible to account for the curious stream of ideas which may flow through the mind, and for phenomena such as a particular occasion and a certain individual often being associated together. Things that are alike have a tendency to appear together. Thus a story that has much the same point may come to consciousness upon the hearing of a similar story. Objects may be so different that they tend to recall each other. The familiar contrast between the toad and the elephant is an example of this form of association. White is often thought of in connection with black, round in connection with square and right in connection with wrong.

The emphasis placed at present upon the conditional reflex in learning is simply a more modern approach to phenomena described by the older laws of association.

**ASSOCIATIONS**, in the broadest sense, organizations of people having similar interests and working together towards a common end. Being an outcome of man's gregarious nature as expressed in community life, associations exhibit an exceedingly wide range in character, taking in all phases of man's activity.

The study of primitive cultures (see CULTURE) reveals a form of association in which the purpose

and proceedings are kept secret from the rest of the community (*see* AGE SOCIETIES). Membership in these secret societies has usually been restricted to males, female organizations which have occasionally developed being usually imitative and concerned chiefly with fertility rites. These organizations as known to-day play a significant rôle in the society of which they constitute a part. Extremely complex, they combine political, religious, economic and in numerous instances, educational functions. Revolutionary political schemes and antisocial or unlawful projects have given rise to many secret societies; particularly in countries undergoing innovations in government, as in China, Italy and Spain. American universities have fostered the development of fraternities which resemble secret societies in that they have a secret ritual and initiation ceremony.

Another form of association is the club which has, after a fashion, been characteristic of Greek and Roman life. The intellectual meetings in Greece, with Socrates as the center of attraction, discussing such subjects as truth, beauty, love, death, the soul and the state; and the informal conversation in the Roman baths were semblances of modern clubs. The development of coffee houses in London during the 17th century gave a tremendous impetus to the growth of clubs, since they supplied permanent quarters in which to hold meetings. The 18th century witnessed an almost bewildering increase of clubs, literary and social organizations being particularly peculiar to this period. Dr. Samuel Johnson held the reins of the celebrated Literary Club, which still exists and which, for the last 200 years or more has had celebrities as its members. Many innovations sprang up during the 19th century. Clubhouses, frequently magnificent structures, were erected and new types of clubs, i.e., 'varsity, sport, theatrical, Bohemian, professional and artists', were created.

Women's clubs in the United States were united in 1889 under the General Federation of Women's Clubs. They are concerned with philanthropic, artistic, literary, educational, legislative, social and religious phases of society.

Boys' and girls' clubs are chiefly social or recreational institutions, frequently organized and supervised by adults to provide them with a healthy environment. In agricultural centers the 4 H CLUBS, which function to interest boys and girls in raising crops and stock, are very active.

England, as the source of the Industrial Revolution, was the first country to have TRADE ASSOCIATIONS. These were established before the 19th century and by the opening of the 20th, had been organized in almost all industries and had spread to all industrial countries. They involve one or more of the following functions: Commercial, acting as business agencies which furnish general information; industrial, controlling, if possible, the significant influences affecting commerce; and protective, directed against labor unions, discrimination in freight rates and the introduction of unfair business methods.

GANGS are antisocial organizations, being, at one extreme, diffuse and amorphous and at the other highly integrated and organized groups with criminal habits. Juvenile community organization and the failure of religion and education to penetrate into the social life of boys are the factors which essentially cause the formation of gangs. Gangs composed of adolescents invite truancy and facilitate delinquency, while adult gangs, aside from their usual criminal activities, are involved in politics and in capital and labor hostilities. To combat effectively this type of association, it is necessary to attack it as a unit, since the punishment of isolated individuals has no effect on the group. Many organizations, such as brotherhood republics, social settlement clubs, Boy Scouts, boys' clubs and the Y.M.C.A., are working to that end.

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**ASSUAN** or **ASWAN**, a small city of Upper Egypt, on the east bank of the Nile below the first cataract, nearly 600 mi. from Cairo.

Assuan has large granite quarries, and is a winter resort visited by many tourists. The stones for the great obelisks and colossal statues of ancient times were procured here from the granite quarries of the Pharaohs. The huge **ASSUAN DAM** was built in 1902. The beautiful temple of Isis is buried under the waters of the dam. Pop. 1927, 16,458.

**ASSUAN DAM**, located on the Nile at the First Cataract, 590 mi. above Cairo, is the most important irrigation structure in Egypt. It is a gravity type dam of granite rubble masonry, pierced by 180 sluiceways through which flood waters pass. As originally constructed, 1902, it had a height of 88 ft. above river bed and 96 ft. above lowest foundation level, a length of 6400 ft. and created a storage reservoir of 37 billion cu. ft. capacity. Nine years later it was heightened 16 ft., increasing the reservoir contents to 89 billion cu. ft., and the masonry volume to 1,200,000 cubic yards. After a further lapse of 20 years the dam is again being heightened, this time, 30 ft. The enlarged reservoir will extend 230 mi. upstream to the Sudanese border and hold 174 billion cu. ft. of water.

**ASSUMPTION, FEAST OF**, celebrated by the Catholic Church on Aug. 15th in honor of the Virgin Mary. Nothing is certainly known either of the year or of the manner of the Virgin's death, but her tombs were reported by tradition both at Ephesus and Jerusalem. An apocryphal treatise bearing the name of St. John, though it belongs to the 4th or 5th century, contains the basis for a belief in the corporeal assumption of the Virgin which is held to be universal among Eastern Orthodox and Roman Catholics. According to this tradition, Mary died in the presence of the Apostles and was buried. Thomas, the realist among the 12, insisted that the tomb be opened, when it was found to be empty.

**ASSURBANIPAL** (ruled 669-626 B.C.), Assyrian king, succeeding his father Essarhaddon, a great

warrior under whom Assyrian power first reached its zenith and then began rapidly to decline. After completing the conquest of Egypt, his armies were driven out by Psammetichus, 660 B.C., who permanently shook off the Assyrian yoke. Discord in Babylonia fostered by Samassumyukin, brother of Assurbanipal flared into open war, in which the Elamites and many Arab tribes joined Samassumyukin. One by one the disaffected cities fell before Assurbanipal, Babylon surrendering in 648 B.C. But too great a



THE DEITY OF ASSHUR  
*Bas-relief of the winged, eagle-headed god of Assyria. In the British Museum*

drain had been made upon the resources of Assyria, and a few years after the death of Assurbanipal the once mighty empire collapsed. Assurbanipal's interest in literature caused him to collect a splendid library at Nineveh. Sculptured slabs of stone found upon the site of this library shed much light upon Assyrian and Babylonian civilization.

**ASSYRIA.** See BABYLONIA AND ASSYRIA.

**ASSYRIAN ART.** The Assyrians derived their art, along with other phases of culture, from the Babylonians. This is especially true of architecture, the remains of which consist chiefly of royal palaces belonging to the period of Assyria's greatness from the 9th to the 7th century B.C. Although they possessed stone in abundance, the Assyrians made little use of it as a building material, preferring to copy the Babylonians in employing bricks, sun-dried and baked, almost exclusively. Stone was used, however, for facings of walls, flagstones, interior ornamentation, and sometimes as capitals for columns. As in Babylonia, the principal structures rested on a large brick platform which not only served as a protection against floods, but gave a more imposing character to the structural whole. On such terraces rose the royal palaces, the chief buildings of Assyria. These dwellings, though only one story high, often attained a magnificence and splendor unsurpassed in succeeding ages. They consisted of great courts surrounded by a maze of chambers and passage-ways. The immense brick walls running through the buildings were some-



ISHTAR, THE MOTHER GODDESS  
OF ASSYRIAN MYTHOLOGY  
*From a bas-relief*

times as wide as the chambers themselves, often reaching a thickness of 30 feet. The palace of the King Sargon II at Khorsabad, built in the closing years of the 8th century B.C., occupied about 25 acres and contained nearly 1000 rooms.

Perhaps the most striking architectural feature of the ancient Assyrian cities were the "ziggurats." Like the Babylonian temples, these were huge pyra-



ASSYRIAN KING RECEIVING AN ENEMY  
SUING FOR PEACE  
*From a bas-relief in the British Museum*

mid-towers of several stories built one upon the other, each smaller than the one below. On the highest stage, ascended by a ramp, was the shrine of one of the chief gods. The temple of Borsippa at Birs Nimrod had a ziggurat of seven stories, the lowest being 272 feet square. Each of the stories was dedicated to one of the seven known planets, including the sun and moon, and was decorated with the color proper to its luminary.



ASSYRIAN KING ATTACKING A CITY  
*From a bas-relief in the British Museum*

Assyrian architects employed the masonry arch, the barrel vault and, as recent discoveries seem to prove, even the dome. Representations on reliefs show that the column also was used.

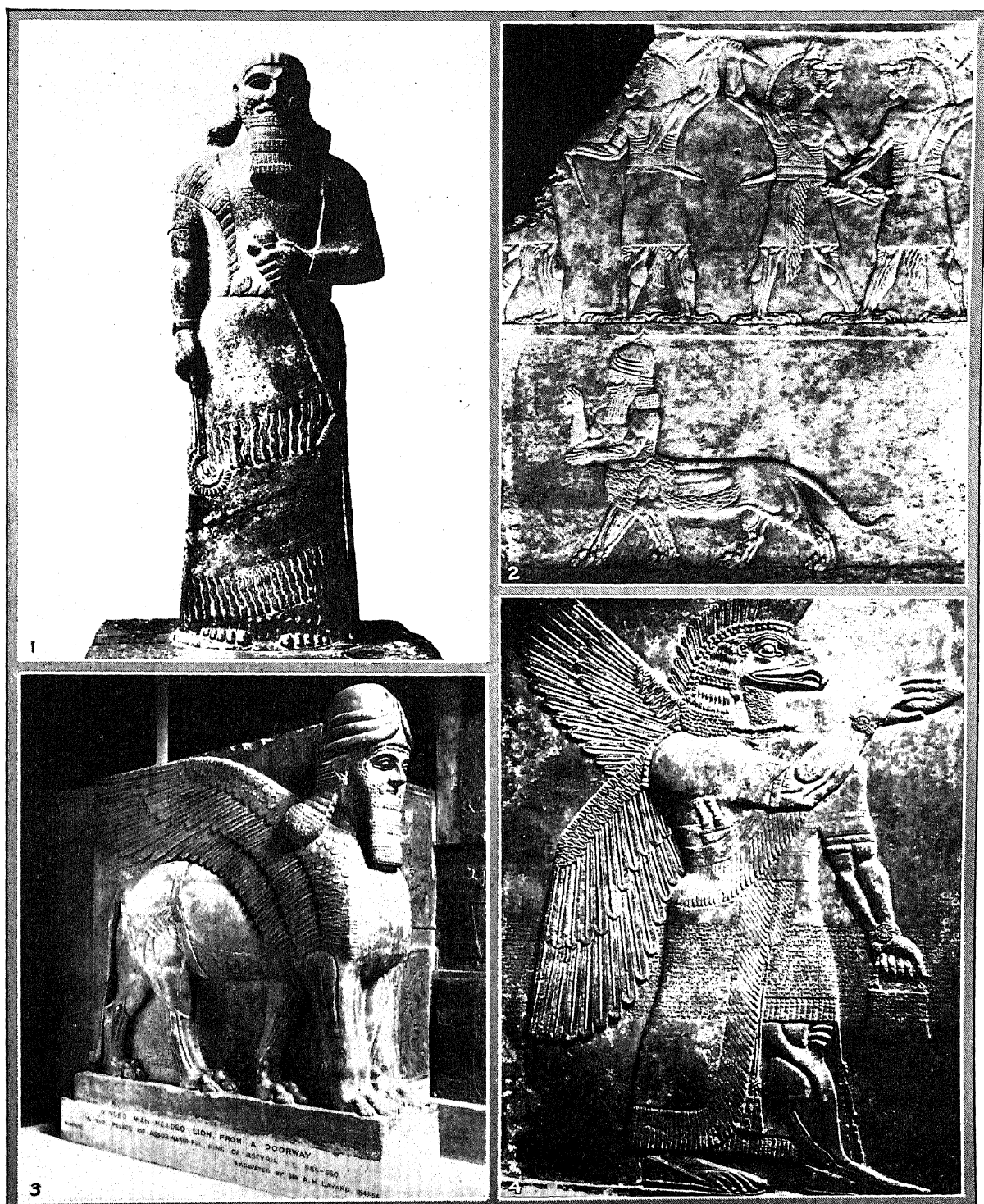
Adding to the splendor of palaces were the interior decorations of painted stucco, carpets and hangings, panels of precious wood, enamelled brick and, above all, painted bas-reliefs on slabs of limestone and ala-



ASSYRIAN ROYAL PARTY HUNTING LIONS  
*From a bas-relief in the British Museum*

baster. Most of these reliefs, which covered the walls of the principal chambers, depict the exploits of monarchs at war and at the chase, favorite pursuits of the Assyrians. Some of these scenes are revoltingly cruel, showing the flaying, impaling and blinding of captives. But they all possess a dramatic, life-like quality which gives to Assyrian sculptures a peculiar importance in the realm of art. In the repre-

## ASSYRIAN ART



FROM PHOTOGRAPHS OF THE ORIGINALS IN THE BRITISH MUSEUM

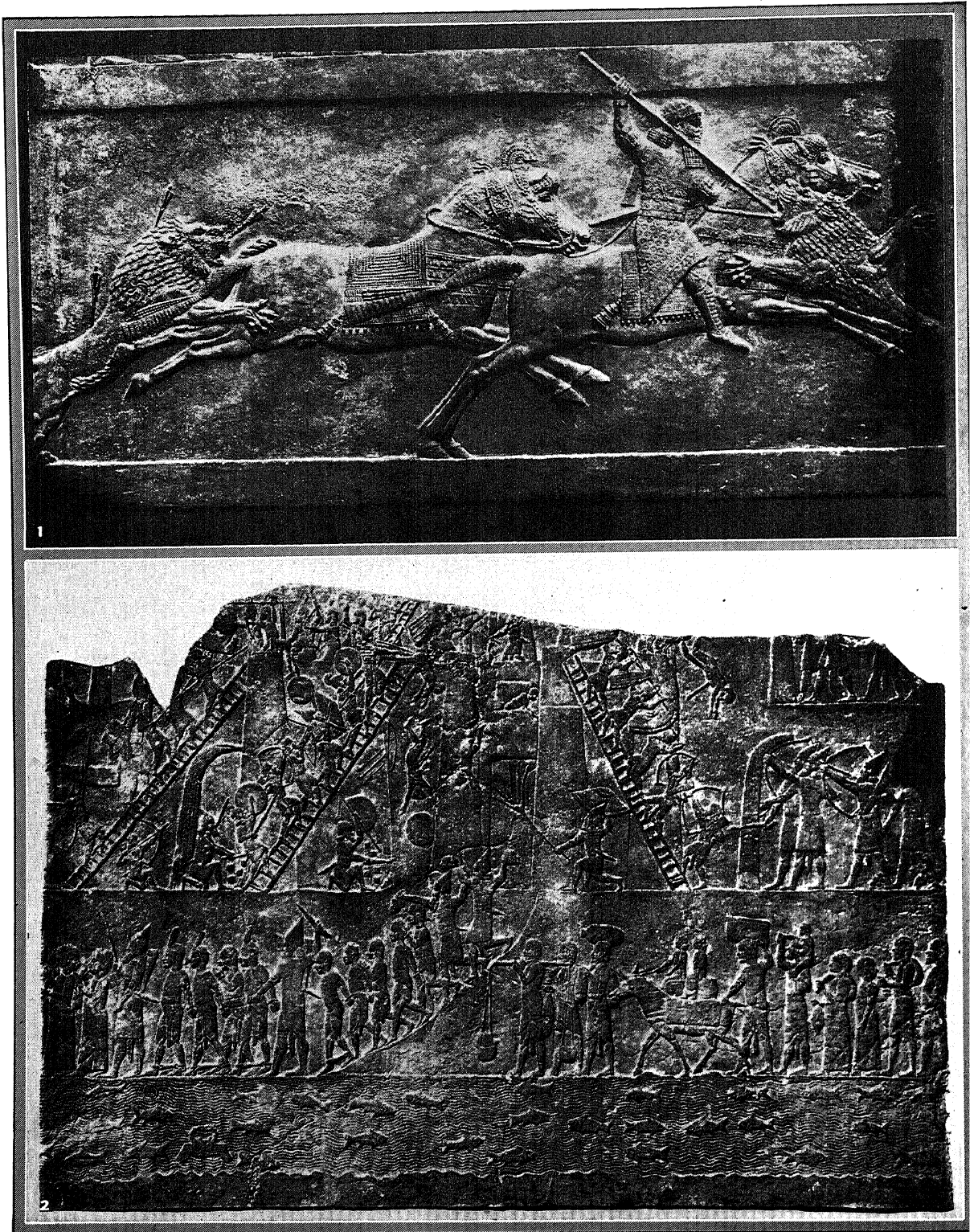
## ASSYRIAN ART

1. Assur-nasir-pal, a statue in the round of an Assyrian King with stylized treatment of hair and beard. 2. Portion of a frieze in low relief depicting warlike god and sphinxes, 668-626 B.C. 3. Winged man-

headed lion, from a doorway in the palace of Assurnasir-pal, King of Assyria, 885-860 B.C. 4. The Assyrian god Ashur. An Assyrian low relief dating from about 885-860 B.C.



## ASSYRIAN ART



FROM PHOTOGRAPHS OF THE ORIGINALS IN THE BRITISH MUSEUM

### RELIEFS OF THE ANCIENT ASSYRIANS

1. Assur-nasir-pal spearing a lion attacking a horse.
2. Siege of an Egyptian city, of about 667 B.C., a war-relief of Ashurbanipal from Kuyunjik at Nineveh.

sensation of animals, particularly, sculptors achieved perfection; their hunting scenes picture beasts in all their pain, terror and fury, with an intense realism seldom surpassed. The human figures, with the conventional curled hair and beard, show strong model-



ASSYRIAN KING TAKING A CITY  
From a bas-relief in the British Museum

ing, the Assyrian artists delighting in exaggerating the muscular forms. Paints of dull shades were used on bas-reliefs to emphasize the details.

Of sculpture in the round, the most characteristic examples are the colossal human-headed, winged bulls and lions that flanked the palace doorways.

In the minor arts the Assyrians were skilled craftsmen. A high decorative quality is displayed in their furniture, embroidery, carpet-weaving, tapestry and metal-work.

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**ASTER**, a numerous genus of perennial herbs of the composite family comprising many strikingly handsome, autumn-flowering plants. There are about 250 species, natives chiefly of North America and sparingly represented in Europe, Asia and South America. They are mostly strong, leafy-stemmed herbs bearing numerous flower-heads commonly in clusters. Each flowering-head consists of a central disk of minute yellow flowers encircled by many showy white, red, blue or purple rays. In North America there are about 200 species widely distributed throughout the continent but most numerous in the northeastern states and adjacent Canada, some 45 occurring in the state of New York. They are numerous also in the Rocky Mountain region and in the Great Basin, where about 50 species are found; upwards of 20 are native to California. In the eastern United States asters and goldenrods constitute a characteristic feature of the autumn flora, growing in immense profusion in woodlands, fields and roadsides. Noteworthy species are the New England aster (*A. novæ-angliæ*), with large, purple flowers, the smooth blue aster (*A. lævis*) and the New York aster (*A. novi-belgii*), with bright violet flowers, all of which are widely cultivated. The common aster of the Pacific States (*A. chilensis*) bears white flowers varying to blue and lavender. The closely allied China aster (*Callistephus chinensis*) is a hardy annual widely cultivated in an immense variety of forms and colors. See **ASTER, CHINA**.

**ASTER, CHINA** (*Callistephus chinensis*), a handsome plant of the sunflower family, one of the most widely grown of garden annuals. It owes its popu-

larity to its late summer season of bloom and its wide range of sizes, forms and colors. When introduced from China about 1731 by the Jesuit missionary, d'Incarville, it was a single white, blue or violet flower. Shortly afterwards red and double forms arrived from other sources and varieties appeared in rapid succession. As late as 1845 the term "German" was applied to many varieties because the greatest improvements had been made in Germany where the main supply of seed was obtained. The quilled, high centered, stiff form has been replaced by loose, flat-rayed, fluffy flowers which suggest their close relationship to chrysanthemums. In color asters appear in all tints between purest white and deep blue as well as rich red. There are, however, no yellows. California and New York are the chief sources of seed. All varieties are of easy culture in any garden soil, but to secure early flowers seed is sown in green-houses or hotbeds during late winter. When the seedlings begin to crowd they are placed singly in shallow boxes or small flower pots, from which they are transplanted out of doors when danger of frost has passed. For late bloom the seedlings are started out of doors when spring opens and transplanted when they begin to crowd.

M. G. K.

**ASTEROID**, or planetoid, a small celestial object belonging to that large group of bodies that revolve around the sun between the orbits of **MARS** and **JUPITER**. From Kepler's time on astronomers had felt that the lacuna between the orbits of these two planets was too great, that there must be another planet somewhere in the interval. Such a planet was searched for all during the 18th century and finally one was found on January 1, 1801. Within a few years three more were found, and at present their number totals over 1,000. Probably at least as many more have been seen once or twice, but have vanished again before their orbits could be determined. Their orbits are in the average much more elliptical than those of the planets, and much more inclined toward the plane of the ecliptic.

Some of them, such as Eros, Ganymede and Albert, may come well inside the orbit of Mars, while others, such as Hidalgo, go out almost as far as Saturn. They are generally small in size, ranging from 480 miles for Ceres, the largest, to only a few miles in diameter for the smallest. Their masses are infinitesimal, and it seems probable that even their combined mass is less than 1/1000 that of the earth. It is possible, though at present it appears not very probable, that the asteroids have their origin in one or more explosions of what once was a single planet.

W. J. L.

**ASTEROXYLON**, one of the earliest known land plants, found fossil in silicified peat-beds in Aberdeenshire, Scotland. In appearance, habit, and anatomy it resembled living club-mosses. Erect branching shoots, densely covered with small, narrow leaves, rose from a smooth underground stem, true roots, as in the simpler associated plant, *Rhynia*, being wanting. Microscopic study of sections reveals a relatively complex stem structure in which the woody elements



are arranged in the form of a many-rayed star, hence the name. Spore-sacs, not unlike those of Carboniferous ferns, have been attributed to this plant, but the character of the fruiting is uncertain.

**ASTHENOSPHERE**, the zone of the LITHOSPHERE lying between 30 and 800 mi. beneath the crust. The rock material therein, although subject to pressures of about 2,000,000 lbs. per square inch, nevertheless undergoes occasional local melting due to the fact that the asthenosphere cannot conduct the heat to the surface as fast as received from the STEREOSPHERE, the zone below. Local rises in temperature bring about liquefaction and the formation of MAGMAS. It is probable that isostatic adjustments occur also in the upper part of the asthenosphere. *See also* BARYSPHERE; GEOLOGY; GEOPHYSICS.

**ASTHMA**, a disease characterized by spasms of difficult breathing, and caused by an abnormal sensitiveness to substances contained in foods eaten or in pollen and dusts inhaled.

The mechanism of the condition is as follows: The presence of the offending substance irritates the nerve endings in the mucous membrane of the respiratory tract. This causes spasmodic contraction of the small bronchioles of the lungs, thus impeding the breathing. The patient breathes more deeply to compensate for it. Now, as the inspiratory muscles are stronger than the expiratory muscles, which cannot, moreover, cope with the resistance of the closed air-channels, the chest becomes so distended that the patient is distressed. He begins to cough, some of the mucus is carried up and the bronchioles relax. This ends the attack of what is known as bronchial asthma.

The substance precipitating the attack may be almost any protein which may come into contact with the body. Each patient has a hypersensitiveness to one or more specific proteins which will induce the attack either when they enter his stomach in food or when breathed into the lungs in the dust in the air (*see* ALLERGY). Seasonal asthma is usually precipitated by pollens of different plants, which mature their pollens at different periods in the season, and the attack coincides with the time when the pollen is in the air (*see* HAY-FEVER). Non-seasonal asthma is frequently caused by such substances as horse dander, cat fur, and feathers, which may be in house dust or barnyard air. Asthma may also occur soon after meals and be dependent upon taking offending substances into the stomach. These may be eggs, milk, shell-fish, meats, or cereals.

It has been found that if minute amounts of a number of suspected proteins are rubbed into abrasions made in the skin, the offending substance will produce a large itching, red wheal and thus be detected. If measures are then taken to avoid these materials, attacks will cease. In some cases, the responsibility can be fixed on no substance. Such patients are usually found to have a chronic bronchitis and the asthma is induced by the bronchial irritation and toxins. The condition is thus an asthmatic bronchitis rather than a true bronchial asthma.

As many asthmatic patients do not react to the ordinary proteins eaten or inhaled, the symptoms may be of bacterial origin or due to the body processes. These cases are difficult to handle.

It has been shown that a large percentage of children whose parents have either asthma or hay-fever will have a tendency to these affections, or to related diseases due to food hypersensitiveness, such as urticaria, eczema, migraine and certain forms of abdominal allergy.

Regarding treatment, successive injections of small amounts of the protein will desensitize the patient in many cases, and is usually effectual. Hence the prime principle in the treatment of asthma consists in determining the source and avoiding contact with it. However, almost spectacular and instantaneous relief during attacks may be procured by inhalation of a spray of ephedrine, and by the use of adrenalin hypodermatically. These two drugs relieve the bronchial spasm by action on the nerve endings. The inhalation of burning belladonna leaves often partially relieves the distress.

Bronchial asthma is not to be confused with cardiac asthma, which is a paroxysmal form of dyspnea.

R. M. B.

**ASTIGMATISM**, term used in LIGHT to denote the condition that exists when rays from a point are transmitted or reflected by a LENS or MIRROR and come to a focus along a short line rather than at a point. This occurs when light falls obliquely on a lens or a mirror. It also occurs if the focal length of the lens or mirror is different in two planes at right angles to each other due to a different curvature in these two planes, i.e., if the lens or mirror is somewhat curved. The term is used very commonly in connection with the EYE when the surfaces of the lens and the cornea, chiefly the latter, are not symmetrical about their axis. It may be detected in the eye by viewing radial lines, since those in a certain direction will be in better focus than those in other directions. It is corrected by using glasses, the lenses of which are curved in the reverse direction to such an extent that the total curvature is the same in all the axial planes. *See also* ABERRATION IN OPTICAL SYSTEMS; AMETROPIA.

P. I. W.

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**ASTOLAT**, in Tennyson's *IDYLLS OF THE KING*, the native abode of Elaine, "the lily maid." It has been identified by some scholars with Guildford, in Surrey, England.

**ASTON, FRANCIS WILLIAM** (1877- ), English chemist, was born at Harborne, Sept. 1, 1877. By his application of spectroscopic analysis to the problem of atomic weights he was led to formulate the modern theory of isotopes in order to account for the fractional atomic weights of many elements. In association with FREDERICK SODDY he was awarded the Nobel prize for Chemistry in 1922. In that year he published *Isotopes*.

**ASTOR, JOHN JACOB** (1763-1848), the founder of a family of American merchants and capitalists,

which in four generations amassed one of the largest fortunes of the United States. He was born at Wall-dorf, Baden, Germany, July 17, 1763. He left his home at the age of 17, and went to London, where he studied the language and read every available volume on America. In 1783 he sailed, taking with him seven flutes as merchandise. Learning of the profits in fur-trading with the Indians, he quickly rid himself of his flutes. By his industry, hard common sense, and thriftiness, Astor was soon influential in the fur business. In 1785 he returned to England with a shipload of furs. The following year he opened a trading store in New York City. His capital began to increase, permitting him to make annual trips to Montreal to buy furs, which, in a few years, he was sending to all parts of Europe and to the Orient. By 1798 he had amassed a fortune of \$250,000. His greatest achievement was the establishment of a string of fur posts to deal directly with the Indians in the vast territory lying between the Great Lakes and the Pacific. He established Astoria, a settlement at the mouth of the Columbia River whence he planned to ship the furs to the Orient, but the station was seized by the British in the War of 1812. He invested most of his profits in New York real estate, the basis of the family fortune. In 1815 he abandoned his China fur trade, and with his son William organized the American Fur Co. In his last years he devoted himself to perfecting plans for a public library (suggested by Washington Irving), for which he left \$400,000. He died at New York, March 29, 1848. His eldest son, William Blackhouse Astor (1792-1875) was born at New York, Sept. 19, 1792. He attended the universities of Heidelberg and Göttingen, and in 1815 became partner in the firm of John Jacob Astor & Son. He increased his father's property holdings, becoming known as the "Landlord of New York," where he died, Nov. 24, 1875. The eldest, John Jacob Astor (1822-1890), was born at New York, June 10, 1822. After studies at Columbia University, he studied law at Harvard. Upon the outbreak of the Civil War, he served as colonel on McClellan's staff. After the death of his father in 1875, he devoted himself to the work of various philanthropic institutions, and gave generous support to the Astor Library, New York. He died at New York, Feb. 22, 1890. His son, William Waldorf Astor (1848-1919), was born at New York, March 31, 1848. He studied law at Columbia University, and in 1877 was elected to the State Assembly. In 1882 he was appointed minister to Italy. During the next eight years he wrote several historical volumes (among them "Sforza, a Story of Milan"), and in 1890 undertook the management of the Astor estate, constructing the Waldorf section of the Waldorf-Astoria hotel in New York. The same year he moved to England, where in London he became owner of the *Pall Mall Gazette* and *The Observer*. In 1899 he became a British subject, and in 1917 was created a viscount. He died at Brighton, Oct. 18, 1919. His younger son, John Jacob Astor

(1886- ), was born May 20, 1886. He joined the 1st Life Guards in 1906, served as major in the World War, and in 1922 purchased the London *Times*. The same year he was elected to parliament from Dover.

The present head of the family in the United States is (William) Vincent Astor, born at New York, Nov. 15, 1891, son of John Jacob Astor and grandson of William Backson Astor.

**ASTOR, NANCY WITCHER LANGHORNE** (1879- ), first woman member of the British parliament, was born at Mirador, Virginia, on May 19, 1879. In 1897 she married Robert Gould Shaw, of Boston, and in 1903 obtained a divorce. Three years later she married Waldorf Astor, eldest son of the first Viscount William Waldorf Astor. When the latter became Viscount Astor on his father's death in 1919, Lady Astor took his place as Unionist candidate for Plymouth, and was elected. Her first interests in Parliament were those concerned with the problems of women and children. She was reelected at the general elections of 1922, 1923, 1924, 1929 and 1931.

**ASTORIA**, a district in Queens Borough, Greater New York City, on the western end of Long Island, N.Y. It is situated on the East River and served by two elevated lines. Pianos and automobiles are leading manufactures. Astoria is a moderately inexpensive residential suburb. It was founded by William Hallet in 1652, and known as Hallet's Cove until it was renamed for John Jacob Astor by Stephen A. Halsey, an old friend and associate of Astor's. The village of Astoria was incorporated in 1839, and later was included in Long Island City.

**ASTORIA**, a city, port, and the county seat of Clatsop Co., Ore., situated on the Columbia River about 100 mi. from Portland. It is served by the Spokane, Portland & Seattle railroad, steamers, and by bus lines. Astoria is an important shipping and industrial city with salmon canneries, flour, lumber and fertilizer mills, and dairies. In 1929 the retail trade amounted to \$7,109,214; the total output of manufactures was \$6,851,870. Founded in 1811 by the John Jacob Astor expeditionary parties, Astoria is the oldest white city west of the Rocky Mountains. Pop. 1920, 14,027; 1930, 10,349.

**ASTRAGALUS**, a very large genus of herbs and shrubs of the pea family, found widely in dry soils throughout the world except Australia. There are about 1,500 species, more than 200 of which grow wild in the United States, chiefly west of the Mississippi. The common forms, frequently called milk-vetch, are usually low herbs bearing divided leaves and somewhat pealike, white, purple or yellow flowers. Notwithstanding the great number of species, the group contains surprisingly few plants of economic value. Several west-Asian kinds yield gum tragacanth; an European species is grown for its seeds, the so-called Swedish coffee; various Old World forms are used as ornamentals, and, in the United States, a few native species with brightly colored flowers are sparingly cultivated. The loco-weed (*A. mollissi-*

*mus*), found in the Great Plains region, is one of the plants that, when eaten, causes the peculiar "loco" disease in livestock.

**ASTRAKHAN.** See **FUR**.

**ASTRAKHAN**, one of the largest cities in the Lower Volga Region of the R.S.F.S.R. The city is on a large island formed by the Volga River near its mouth, with three hills and a swampy plain comprising its area. Below sea level, with a damp climate and primitive sanitation, Astrakhan is frequently visited by floods and disease. Its situation near the Volga's outlet into the Caspian, however, makes it a busy sea and river port, and in the fish and caviar trade it ranks first in Russia. Other exports include fruits, Astrakhan or Persian lamb, wines and lumber. Trade with the Orient has prevailed for centuries. During the season the harbor holds many vessels. The population is extremely heterogeneous. Astrakhan was established in the 13th century. Invasions by Mongolians, Turks and Persians, and internal uprisings and revolts have occurred in its history. On the highest hill, rising 46 ft., is the Kremlin, a walled military town which contains an interesting Byzantine cathedral. On the Volga's banks is preserved the house of PETER THE GREAT. There are many public buildings, numerous churches, a university and museums. Pop. 1926, 195,232.

**ASTRAL BODY**, a name for the double or spirit-counterpart of the self, especially as used in THEOSOPHY. It represents a special phase of the belief in GHOSTS.

**ASTROLABE**, an instrument at one time used in navigation for taking the altitude of the sun and stars. This instrument has been superseded by the SEXTANT.

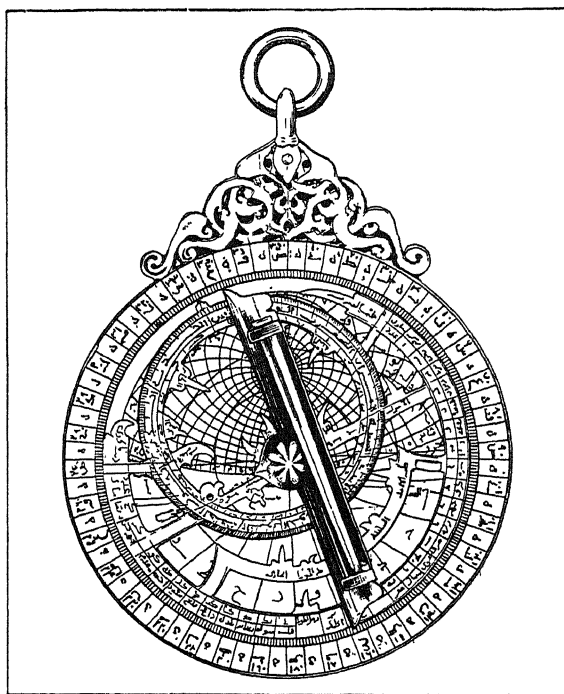
**ASTROLOGY**, a system of forecasting the qualities and fate of men from the position of the heavenly bodies. Astrology belongs to the most ancient form of knowledge and is the predecessor of ASTRONOMY. That phase of it concerned with the observation of the positions of sun, moon, stars and planets was known as *natural* astrology; the use of it for prediction, *judicial* astrology. The basic instrument of prediction was the HOROSCOPE, or nativity, which represents the celestial relations at the time of birth. The idea underlying this is that the heavenly bodies exert an influence upon the earth and its inhabitants.

Astrology was a basic order of knowledge in that it determined the favorable times for human enterprises. If in medicine bloodletting was employed, the astrologer was consulted to determine the favorable time for the operation. Just so for sowing and reaping, for expeditions and business, for love and marriage, the favorable or auspicious periods were determined by an elaborate system of ascendant, arising or favorable, and descendant, declining or unfavorable, aspects, in terms of the houses or divisions of the zodiac, in turn referred to the chief constellations as presiding in them. By associating the 12 signs of the zodiac with 12 parts of the human body, there arose an astrological medicine. Similarly the metals and precious stones were assigned a correspondence

with the planets and became the lucky stone for those born in its sign. General events were similarly forecast as that of a flood in 1524 because three planets would then meet in the sign of Pisces the fish, which controls fate by sea and water.

Astrology readily descended to the level of fortune-telling and other systems of DIVINATION. PALMISTRY transferred the astrological indications to the lines and mounds of the hand, as the face had been read for character traits. Whatever part of face or hand was assigned to Venus became an index of the love life; that assigned to Mars, of fate in war or conflict; to Mercury, affairs of business. Fanciful systems of character-reading from bodily signs thus derived from astrology. It became a part of magic and occult lore generally. Its survivals and revivals are tenacious. It is certainly a strange anomaly in the 20th century to find horoscopes printed in the daily press, similar advice broadcasted, and thousands of intelligent persons consulting professed astrologers. J. J.

**ASTRONOMICAL INSTRUMENTS**, as used in modern times are, chiefly, the TELESCOPE and its accessories. The telescope may be mounted either as



COURTESY M. M. OF ART

LATE 13TH CENTURY ASTROLABE OF EITHER ARABIAN OR YEMENY ORIGIN

*Since ancient times the astrolabe was used for observing the stars, and has only been replaced by the more accurate sextant*

a meridian circle or transit instrument, or as an equatorial. It may be a refractor or a reflector, and may be adapted for either visual or photographic work. The accessories include the micrometer, spectroscope, spectroheliograph, photometer, bolometer, radiometer, interferometer, clock and chronograph.

**ASTRONOMICAL SOCIETIES**, organizations of astronomers formed to further cooperation and exchange of thought. Among the most important are: the International Astronomical Union, affiliated with the International Research Council, the Royal Astronomical Society, of England, the *Astronomische Gesellschaft* of Germany and the American Astronomical Society.

**ASTRONOMICAL UNIT**, the distance from the earth to the sun, equal to 92,870,000 miles, and used as the unit of distance in the solar system.

**ASTRONOMY**, the science of the heavenly bodies, the stars, sun, moon, planets, with their satellites, and the comets. It is one of the oldest sciences, possibly the oldest of all, probably because it was the first science necessary to man. From being a mere necessity it has grown into a pure science lifting man's thoughts away from the earth upon which he lives, and towards the stars and the universe at large.

That astronomy must have forced itself upon the mind of even the most primitive man is evident. The phenomenon of the rising and setting of the sun, with the resultant day and night is too obvious to escape attention. In temperate climes there are, in addition the sun's higher arch across the sky in summer, with longer days and first growing, then waning heat; and its lower arch in winter, accompanied by shorter days, cold and snow. The moon, which looks as large as the sun when its disk is fully illuminated, is hardly less conspicuous, and even more mysterious, with its ever-changing aspect, from a narrow thread of light in the evening sky to a half disk, then to the round disk of the full moon, narrowing again to a half disk and finally shrinking to a thin sickle that fades into the rays of the morning sun. Still more perplexing were the planets, not twinkling, but shining with a steady light, perpetually wandering among the stars, now here, now there, some always hovering near the sun, while others moved more freely; and the stars themselves, rising and setting, but appearing at different times in different seasons. Finally, there were the sudden and terrifying appearance of comets, blazing forth in the nocturnal sky; the falling of meteors, or "shooting stars," the awesome, heart-chilling spectacle of eclipses of the sun. All these things celestial must have made a deep impression upon the mind, and compelled the wonder and questioning of mankind since time immemorial, that wonder and curiosity which started man's desire to unravel the enigma of the heavens.

**First Applications of Astronomy.** It is very likely that astronomy found its first applications in guiding human beings on land. In remotely ancient times the caravans crossing the deserts of Central Asia had only the sun and the stars to show them their course of travel. Then, too, in those lower latitudes where probably stood the cradle of the human race, twilight lasts only a short while, and the stars blaze forth very quickly after sundown. In a few hours the sky has changed again, new stars appear in the east, while others sink below the horizon in the west,

and the careful watcher can almost see the star-dotted dome revolve above him. By midnight half the sky has changed, and when the first faint light of dawn shows in the east again, almost the entire sky has changed. The shepherds and other star-watchers of the East, in Egypt, in Chaldaea, in India, must have been fascinated by the majesty and mystery of the stars, and it is easy to understand how, watching with reverence and profound interest, they would in time become familiar with the whole magnificent scenery of the night sky. They would note the score or so of bright stars, the hundreds and thousands of fainter ones, and the MILKY WAY thrown across the sky like a luminous scarf of gauze, circling the sphere of heaven. It was only natural that they should give names to the very brilliant stars, to conspicuous groups, and in their imagination begin to discern figures in them, figures which in time became the constellations.

The day, that is the interval of time between sunrise and sunrise, or sunset and sunset, was too short to be of much use, even for their primitive time reckoning. In describing past events it would have involved numbers too large for them to grasp. So, naturally, when they noticed that the moon, in its perpetual cycle of phases from new moon to new moon, was always exactly the same length, about 30 days, the month became the basis of their primitive calendar. This was especially so in the tropics where the annual change of seasons is not pronounced enough to attract attention. Furthermore, a year is much too long an interval of time for the memory of a savage. In many regions of Central Africa and the West Coast, the natives still speak of so many moons back, and so many moons hence. The natural division of the month into four weeks may have come from the obvious aspects of the phases of the moon: new moon, first quarter, full moon and last quarter. It is possible, too, that closely watching the moon in its backward path among the stars, the ancients saw it pass directly in front and over certain bright stars, covering up and hiding from view these stars for a definite length of time, and it is conjectured that this may have become the measure of the hour. If this is the true explanation, then the hour is not an artificial division of time but a natural one: the length of time it takes the moon to travel its own width. A very early division of the stars in ancient India marked the central band of the sky, swept out by the moon in its circuit, into 30 lunar mansions, each of 24 times the moon's diameter in length. Taking twice the width of the full moon as the unit of measurement, it might thus have come about that they measured off the sky in these 30 lunar mansions, of 12 units each, or 360 units in all, and naturally came to think of every circle as divided into 360 parts, the degrees of modern times.

In upper Egypt, which is not so far north of the equator, the sun rises almost straight out of the eastern desert, climbs high into the sky, and descends almost straight again into the western desert. The whole economic life of Egypt was based on the recurrent

flood of the Nile. The prediction of the flood was of the greatest importance. People had noticed that the stars which appeared at nightfall low on the eastern horizon were well above the horizon a few weeks later at the same hour. Other stars were now on the horizon. Then they noticed that every summer, when the Nile flood began to make its appearance, a very bright star which they called Sothis, the Announcer, or the Dog, and which we call SIRIUS, rose in the east just before sunrise, or heliacal rising. So they concluded that the sun makes a complete journey round the sky in the interval between two Nile floods. By counting the number of days between two heliacal risings of Sirius they found that there are 365 days in the year, and thus laid the basis for our modern calendar.

**Ancient Records of Eclipses.** Eclipses of the sun and moon, especially the former, are phenomena of such commanding interest that they could not fail to force themselves upon the attention of mankind. At the times when "the sun shall go down at midday," and the earth becomes enveloped in a "darkness which may be felt," the simple and unenlightened populace may well have been frightened and terrified. They may have thought of an eclipse as an attempt of a dragon to devour the sun or moon, an attempt which could be thwarted only by making the most devastating din and clamor; but the more thoughtful among them must soon have divined the true cause behind the spectacle. They must have noted that an eclipse of the sun happened only when there was no moon visible in the sky, and that an eclipse of the moon could happen only at full moon. If they had any means of observing the sun's disk while the eclipse was in progress as, say, by looking through a thin sheet of horn, they would have noticed a dark disk, just the size of that of the moon, encroaching upon the sun from the west. It appears, indeed, from the ancient records that at least as far back as 2159 B.C. the Chinese had mastered the art of predicting eclipses, since in that year the two imperial astronomers of China, having become intoxicated, and having failed to acquaint the court with their prediction, were put to death. That in olden times people did indeed observe the eclipsed sun carefully follows from the fact that the ancient UPANISHADS of India speak of the "white form of the sun, the red form of the sun, and the dark form of the sun," showing that they were familiar, not only with the sun's radiant face, but also with the red flames, which we call prominences and which are visible only during a total eclipse; and possibly even with sun-spots.

The ancients must likewise have noticed that five bright objects in the heavens were singled out from the rest, because of their ability to move about among the "fixed stars," in a somewhat irregular fashion. Two of these, they observed, could never stray away from the sun by more than a fixed distance to the east and to the west. The brighter of these, which could also move farther away from the sun was called Shukra, or shining, by the Hindus. The Greeks later

called it Phosphorus, when a morning star, Hesperus as an evening star. The Romans called it Lucifer or Venus. The other, fainter, and more rapidly moving one, the astronomers of India called Buddha, wise. Now we call it Mercury, after the wing-footed messenger of the gods in Roman mythology. The other three wanderers, or planets, as they noticed, moved more slowly in the sky, and, apparently, quite independently of the sun. The brightest one of these shone with a soft, pale yellow light; the second one, more mobile and erratic in its wanderings in the sky, was ruddy in color, and fluctuated much in brilliance; while the third was usually the faintest, and certainly the most sluggish of them all in its motion among the stars. In India the astronomers called these three: Brihaspati, the Great Lord; Mangala, War Lord; and Shani, Slow, respectively; we call them Jupiter, Mars and Saturn, using the Roman names for the God among Gods, the God of War, and the father of the Gods, respectively.

**Progress in India, Egypt and Babylonia.** That the astronomers of India had come far closer to the truth in their conception of the universe than their less enlightened successors for thousands of years to come, follows from the passage in a Sanskrit book, the *Vishnu Purana*, where it is written: "The Sun is stationed, for all time, in the middle of the day, and over and against midnight, in all the regions of the earth . . . there is neither setting nor rising, for what is called rising and setting are only the seeing and the not seeing the sun." In yet another Sanskrit book, the great epic poem called the *Mahabharata*, it is recorded: "The stars, though so small in consequence of their distance, are large." And though only a few thousand stars are visible to the naked eye, Gautama Buddha speaks of a "hundred thousand times ten million worlds" which comes fairly close to our modern ideas of the number of stars in the universe.

In Egypt, and Babylonia too, the factual knowledge of astronomy had made great advances, as is evident from the way their temples, tombs and pyramids were built and oriented. At Karnak (ancient Thebes) the great temple of Amon Ra, the Sun-God, is so oriented that its main axis points in the direction where the sun rises on the longest day of the year. Here, as well as in many other localities, can still be found examples of the oldest astronomical instrument, the gnomon, in the form of huge monoliths or obelisks. In the Great Pyramid of Cheops, built with infinite care between 3,000 and 4,500 B.C., the main passage was evidently built so as to point directly to the north star. The Chaldeans, Assyrians and Babylonians had been proficient in astronomy for as long a time as we have records of them, and some fragments have survived of a work on astronomy written by the King of Agade, Sargon the First, and estimated to be as old as 3,800 B.C. At a much later date they made what might well be called the outstanding discovery of ancient astronomy, viz., the phenomenon known as the PRECESSION of the Equinoxes, or the motion of the North Pole of the heavens among the stars. The Babylonian

astronomer Kidinnu, working in the 4th century B.C., measured the precession and determined its period as 25,900 years. It would appear probable that Hipparchus, who has usually been credited with this momentous discovery at about 125 B.C., derived his knowledge from Babylonia. This is easily explained by the general interchange of ideas between Greek, Babylonian and Persian philosophers after the conquests of Alexander the Great. Moreover, it appears certain that the Greek philosophers Strabo and Ptolemy knew of Kidinnu.

**Beginnings of Astrology.** In Babylonia, however, astronomy did not remain merely a science of observations, nor even a utilitarian craft needed for the making of predictions in connection with agriculture and religious festivals. Astronomy gradually developed into astrology. Man felt himself surrounded by an alien, often inimical and certainly enigmatic universe, by forces of nature which thwarted his best-laid plans, caused droughts and floods, famines and times of plenty, interfered with the fates and fortunes of those within his own circle of acquaintance through sickness, death, pestilence and wars, and accomplished all this without any seeming cause or regularity. He realized that agriculture, upon which depended his livelihood, was governed by the change of seasons. In different seasons he saw the sun, moon and planets in different positions, and among different stars. What was more natural than that he should consider the heavens as the celestial stage upon which the Gods performed and wielded their magic, using the stars, sun, moon and planets as pawns to indicate their caprices to humanity?

Such were, indeed, the beginnings of astrology, and in Babylon the priests, to whom was entrusted the responsibility of observing the stars and placating the Gods, shrewdly saw in it their way to power. They were the only ones who could read the language of the heavens; in them was vested the authority of the heavenly oracle. By foretelling the future, or by remaining silent, they could control the destinies of king and nation.

In the beginning, astrology was considered applicable only to empires or their monarchs, but through the influence of the more individualistic Greeks and Romans, it gradually came to be applied to single human beings, and in this way survived until the 16th century. At the present time it has ceased to exist as a science, and while the later, and greater, truths of astronomy have completely replaced the misconceptions of astrology, we must not conclude that astrology did not once serve a useful purpose. During the several thousand years from Babylon to the Renaissance, astrology was the only all-embracing science. Mathematics and astronomy existed only as tools, and throughout the dark ages the mathematics of the Greeks was studied mainly because it was a necessary means toward the end—astrology.

**Greek Contribution to Astronomy.** The earliest times of which the records are no longer fragmentary, but begin to approach some measure of completion,

are those of the Greeks. Thales of Miletus, during the closing years of the 7th century B.C., introduced the Egyptian astronomy into Greece, and he was the first of the western world to predict a total eclipse of the sun, that of 585 B.C. Pythagoras, earliest of modern philosophers, who lived in the 6th century B.C., taught that the sun stands still, and that the earth travels around it; the same theory that was maintained later, in the 3rd century, A.D., by Aristarchus. When Alexander the Great conquered Babylonia and Persia, he caused many of the astronomical records of the Orient to be translated into Greek, and in time these records were sent to the great university library of Alexandria, in Egypt. There Eratosthenes was keeper of the books, about 250 B.C. He it was, who first devised a method of measuring the size of the earth by observing the altitudes of the sun at Syene, in upper Egypt, near Assuan, and at Alexandria. His calculated result, about 250,000 stadia for the circumference of the earth, is remarkably near the truth, for, if one accepts the value of the stadium to be a little more than 500 feet, as appears probable from historical records, the circumference of the earth turns out to be 24,500 miles. It was this figure of Eratosthenes for the size of the earth which Toscanelli used in his calculations, and which he supplied to Columbus, who used it as an argument for attempting to circumnavigate the globe.

About a century later flourished Hipparchus, often called the greatest astronomer of antiquity, who collected all that was known in astronomy in his time, and added so many of his own ideas and calculations that nothing new was discovered for more than 1,000 years after. His star catalogue and his own original writings became lost, but probably most of them have been preserved by his successor Ptolemy, who lived in Alexandria around 150. Ptolemy incorporated all of Hipparchus's work and views in his great work *He Megiste Syntaxis*, or the Great System, better known by the Arabic corruption *Almagest*; it was the standard reference book of astronomy for 1400 years. Ptolemy followed Hipparchus in subscribing to the view that the earth was forever fixed in the center of the universe, and upon this he built and elaborated his geocentric system, usually called **PTOLEMAIC SYSTEM**, in which he furnished explanations for the complex and diverse wanderings of the planets in the sky.

Although after the time of Hipparchus and Ptolemy all advance in astronomy practically stopped, the science was kept alive by the industrious efforts of the Arabs after the *Almagest* had been translated into Arabic by order of Harun-al-Rashid. From time to time new star catalogues were made, especially in Spain when under the domination of the Moors, and in the east, in Turkestan, by Ulugh Beg, grandson of Tamerlane, who lived in the 15th century.

**Copernicus's Heliocentric System.** Europe as a whole had been sadly neglecting the sciences throughout the Dark Ages, but the general intellectual awakening known as the Renaissance at last brought a change. The discovery voyages extended man's ma-



terial horizon, and his knowledge of the earth. In other directions, too, he began to grope for new ideas. In religion this led to the Reformation; in astronomy it brought the reformulation, by the Polish monk Copernicus, of the ideas of Pythagoras and Aristarchus, that not the earth, but the sun is in the center of the planetary system. Although it cannot be said that the new ideas in these different fields were interdependent—rumor has it that Luther bitterly denounced Copernicus as an arrogant fool—they were at least concurrent. Copernicus's **HELIOCENTRIC SYSTEM** which pictured the sun in the center of the planetary system, with the planets revolving around it in circles, and the earth rotating on its axis, at once provided a simple explanation for the observed motions of the heavenly bodies. Being a faithful son of the Church, Copernicus hesitated to give his unorthodox ideas to the world at large; but his friends prevailed upon him, and at last he consented to have them printed in his great work, *De Revolutionibus Orbium Coelestium*, "On the revolution of the Heavenly Bodies," the first copy of which was dramatically presented to him on his deathbed in 1543.

**Galileo, Kepler and Newton.** Almost at once his ideas were accepted by the more advanced thinkers, such as Giordano Bruno, and Galileo, and although the Danish astronomer Tycho Brahe opposed them, it was the long series of accurate observations begun by Tycho which, in the hands of his pupil and successor Kepler, paved the way for the foundation of a real mechanical explanation of planetary motions, in the form of the well-known **THREE LAWS OF KEPLER**. These, announced early in the 17th century, affirmed that the orbits of the planets are not perfect circles, but ellipses, with the sun slightly off-center; that the speed of a planet in different parts of the ellipse varies in a prescribed ratio, and that furthermore there is a constant relation between the distances of the planets from the sun and their times of revolution.

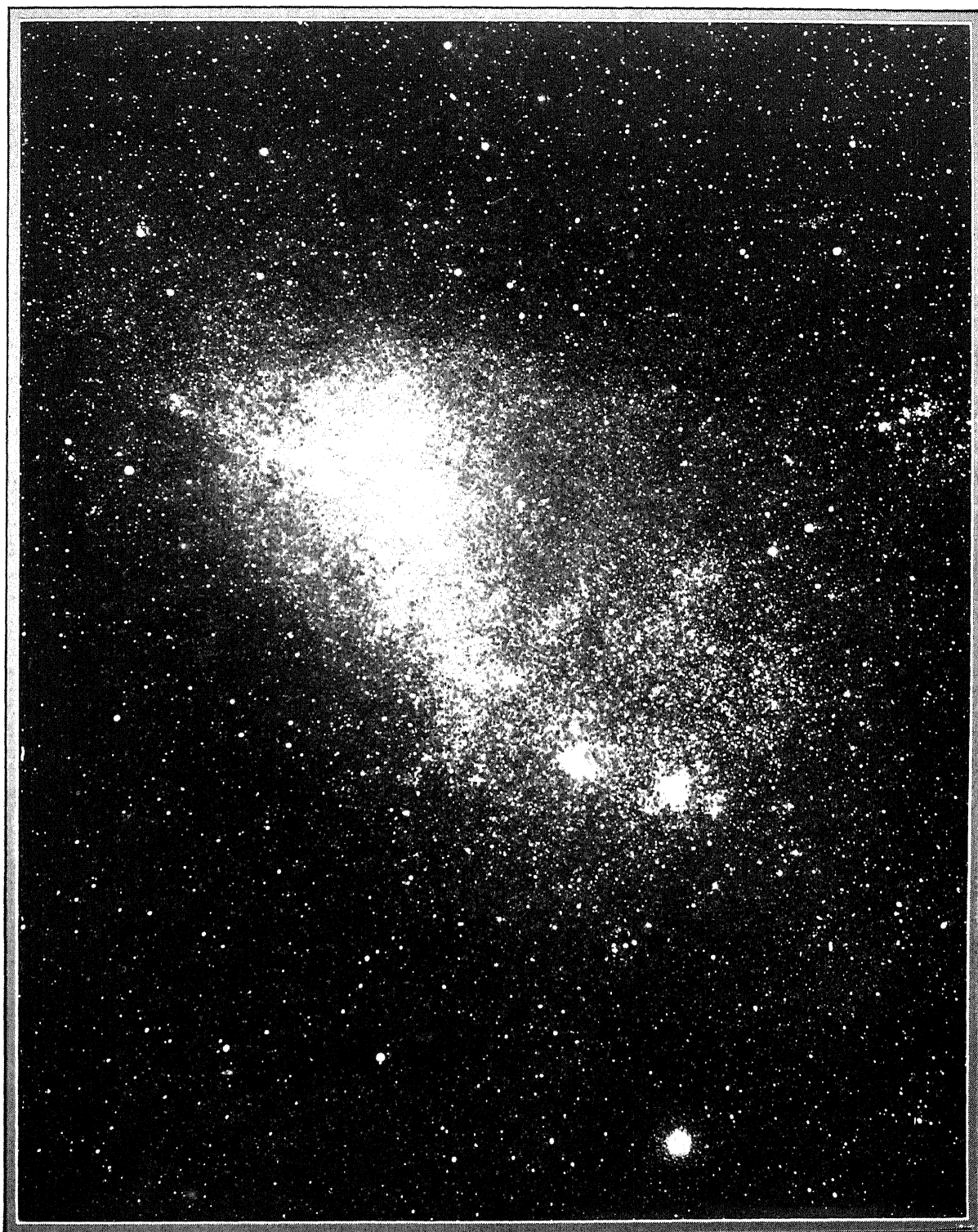
The time was now getting ripe for the final step, and in 1687, 144 years after Copernicus published his views, the culmination came in Newton's enunciation of the law of universal attraction, which, with one stroke explained all the motions of the solar system to the most minute detail. Thus, in less than a century and a half since the correct statement of its principles by Copernicus, in the form of the heliocentric system, astronomy had found its fundamental law, the one instance of a perfect law of nature, whose derivation is generally cited as the greatest achievement of inductive reasoning of all time.

Meanwhile a second revolution had taken place in astronomy, no less significant, and possibly even more far-reaching in its consequences: the invention of the telescope. The actual invention is generally credited to Lippershey, in Holland; but it was Galileo who made the first extensive use of it in astronomy, discovering with it the phases of Mercury and Venus, the mountainous structure of the moon, and in 1609, one day later than Simon Marius in Germany, the satellites of Jupiter, as well as resolving for the first

time some parts of the Milk Way into its individual stars. Literally, the introduction of the telescope into astronomy opened up a "new heaven;" instead of the mere few thousand stars visible to the naked eye, the first telescope showed tens of thousands which soon grew with the improvement of lenses into hundreds of thousands. After Galileo came Huygens, who invented the pendulum clock, and discovered the rings of Saturn; and Romer, who first determined the velocity of light by observations of JUPITER's satellites.

**Modern Astronomy.** Thus astronomy advanced, and during the two centuries following Galileo and Newton it developed along the lines first opened up by them. Newton's law of gravitation was first utilized for making predictions by Halley, while later on the methods and details of its application to all problems of dynamical astronomy were elaborated by Laplace and Lagrange. And although very recently the changes brought about by Einstein's theory of relativity have not left Newton's law unscathed, the actual corrections in the dynamics of the cosmos are so infinitesimal as to be almost unobservable. Newton's law still stands to-day as the one simple and almost perfect law of nature. Improvements in telescopes and methods of observation brought discovery after discovery. Halley first noticed that the stars were not really fixed, but had motions of their own in the sky. Double stars, variable stars, star clusters and nebulae, were discovered, and the assiduous watching of the sky by a number of observers brought comet after comet into our ken. Then, in 1781, came the momentous discovery by William Herschel of a new planet, Uranus, revolving around the sun well out beyond the orbit of Saturn. In 1801 the first asteroid was found, thus filling the apparent gap in the planetary system between the orbits of Mars and Jupiter. As telescopes still more improved, asteroids became more plentiful, and to-day nearly 2,000 are known. When Uranus had been observed for some 60 years, its motion was found not to conform to Newton's law, and the existence of an eighth, as yet unknown, planet was postulated. Its position was calculated by Leverrier and Adams, and the planet, later named Neptune, was promptly discovered in its predicted place: the fitting climax to one of the most brilliant researches in mathematics, as well as constituting an eloquent proof for the validity of Newton's law. About the same time the first accurate measurements of stellar distances were made by Bessel, Struve and Henderson. Thus, also, for the first time, an accurate idea could be obtained of the vast gulf of empty space that stretches between the solar system and the stars in general. Relative motion observed in many pairs of stars proved the existence of many systems of stars in the universe, as well as confirming, through mathematical analysis of this motion, that Newton's law was operative among the stars as well as among the planets. In addition, Herschel discovered, upon analysis of the motion of a number of stars, that the sun is not at rest in space, but is itself, and the entire solar system with it, traveling through the universe.

## ASTRONOMY



COURTESY HARVARD COLLEGE OBSERVATORY

### SEEN IN THE SOUTHERN SKIES—THE SMALLER MAGELLANIC CLOUD

This vast cluster of stars is the nearest of the nebulae to be detected by telescopes. Light from it must travel 30,000 years to reach the earth. The stars are seen as they were 100,000 years ago. Photographed at Arequipa, Peru, by the Harvard Observatory.



**Momentous Changes.** Such was the situation in astronomy toward the latter half of the 19th century, when the almost simultaneous effect of four different factors brought momentous changes in the science: viz., the building of the modern giant telescopes, the introduction of the spectroscope, the application of photography and the adaptation of statistical methods to problems of astronomy. The first mentioned of these culminated toward the close of the 19th century in the construction of the 36-inch telescope of the Lick Observatory in California, and the 40-inch telescope of the Yerkes Observatory near Chicago. Later these were joined by the 60- and 100-inch reflectors at Mt. Wilson and the 72-inch at Victoria. In 1931 a 200-inch telescope was projected for the California Institute of Technology. As a consequence, astronomy has undergone vast changes, and our conceptions of the universe have altered so radically that one might almost say that we are now living in a universe vastly different from that known to the Egyptians and Babylonians. To all the ancients the material universe consisted of the sun, the moon, five planets, an occasional comet, and the starry realms beyond, in which the unaided eye might be able to discern some 4,000 to 6,000 stars. The present-day universe is almost wholly telescopic. The solar system has been enlarged by the addition of three more planets, 25 satellites, a few hundred comets, and nearly 2,000 asteroids, while the number of stars that can be photographed with the most powerful telescopes of to-day must be at least 1,000,000,000, and to this should still be added almost countless external stellar systems, known as ISLAND UNIVERSES. The depth to which we can now explore the cosmos is probably 1,000,000,000 times greater in all directions than can be plumbed with the naked eye.

**Rise of Astrophysics.** The introduction of the spectroscope has made it possible to observe the stars individually, to study their physical characteristics, and their chemical composition, and has thus given rise to a new division of astronomy, astrophysics. Aided by, and in its turn aiding the newest developments in modern physics known as atomic physics and chemistry, astrophysics has become one of the most efficacious means for obtaining a better insight and understanding in the constitution of matter, and its behavior in the universe.

The application of photography has had two far-reaching effects: In the first place the highly sensitive emulsion of present-day plates has made possible the recording of stars and nebulae many times fainter than those which can be seen by the human eye, even through the largest telescopes. In the second place, the photographic plate has become an almost permanent record of the sky, which, once taken, developed and finished, constitutes a veritable storehouse of information, which can be consulted at any time afterwards.

The adaptation of statistical methods to astronomy has added another powerful tool to the astronomer's equipment. Vast amounts of data can be utilized

which would be too inaccurate or too incomplete individually to allow many conclusions to be drawn, but which, taken collectively, lead to the basic laws concerning the structure, the motion and the evolution of the cosmos.

As the name indicates, the first division, which is also the one most sharply separated from the others, deals with the mechanics and dynamics of the universe, that is, with the mathematical analysis of the motions of the heavenly bodies. It is developed exclusively from the fundamental law of universal attraction enunciated by Newton, and it has been essentially the same since Laplace and Lagrange, although its ramifications are now much wider. Great accomplishments in this field can be pointed to in many special problems: the precise determination of the exceedingly complicated motion of the moon; the various problems arising in the motions of the satellites of the planets, especially those of Jupiter and Saturn; the calculation of the orbits of the numerous asteroids around the sun, subject as they are to incessant changes from the attraction of other planets; the simplified ways of finding the path of a comet from a small number of observations; and some quite general researches into the dynamics of the stellar universe.

**Modified Planetesimal Theory.** The question of the origin of the solar system is one which rightly belongs to cosmogony, and thus also jointly to celestial mechanics and astrophysics. The former nebular hypothesis has now been definitely abandoned, and some modification of the planetesimal theory, such as the theory of dynamic encounter appears to be the only one at present which is not at variance with the facts and the fundamental laws of physics. According to this theory, the planetary system originated through the close approach of the sun and another star, at which time a huge disruptive tidal wave was raised on each body by their mutual attraction. A great quantity of matter was ejected from the sun, as well as from the star, and due to the attraction of the passing star was started revolving about the sun in the direction the star was moving. The planetary system developed from this circulating material.

To the field of observational or practical astronomy must be credited the development of the methods of determining latitude, longitude, and the time used in finding a ship's position and in surveying and mapping the surface of the earth.

At a number of observatories, including at least one in each of the leading countries of the world, observations of the sun and some of the brighter stars are made with the meridian circle for the double purpose of providing accurate time for the world and of providing accurate positions of a few stars to which all positions and motions in the heavens may be referred. The positions of the much larger number of fainter stars which in former days were likewise determined by means of the meridian circle are now universally obtained by means of photography, at a substantial reduction in labor and without loss of accuracy. The great photographic undertaking known as the Astro-

graphic Catalogue and Chart was begun at the investigation of an international committee of astronomers during the last decade of the 19th century, and had as its purpose the determination, by international co-operation, of the accurate positions and brightnesses of some 3,000,000 to 4,000,000 stars. More than half the work has been finished, and it is expected that in another 10 or 15 years it will be essentially completed.

Apart from the determination of accurate positions and the calculation of orbits, observations of objects in the solar system have been concentrated in recent years very largely upon the investigation of the physical features of the planets. In these, full use has been made of the new tools of astrophysics, such as the spectroscope and the radiometer, and already fairly reliable information exists concerning the presence or absence of gaseous atmospheres and especially of water vapor and oxygen on the principal planets, as well as concerning the temperatures on their surfaces. From these data, inferences can then be drawn concerning the possible habitability and the existence of life on the planets. The information at present available points definitely toward an impossibility of life, even remotely similar to that which we call by that name on the earth, on any planet except Venus and Mars. On both these planets vegetation of some kind may quite possibly, or even probably, exist.

**Brightness and Color of Stars.** In the field of astrophysics, one of the first problems that should be mentioned is the measurement of the apparent brightness of the stars. The range of apparent brightness is enormous. The brightest star in the sky is 1,000,000,000 times as bright as the faintest still visible in the most powerful telescope. The methods employed in measuring apparent brightness are embraced in the general name of **PHOTOMETRY**. This includes visual photometry, where the human eye is used to estimate brightness; photographic photometry, where the brightness of the stars is recorded upon, and measured from photographic plates; and photo-electric photometry, where the quantity of light is recorded by electrical methods.

The distances of the stars may be determined either directly, by the trigonometric method, by measuring the apparent angular displacement of the stars in the sky, known as **PARALLAX**, as the earth travels around the sun; or by indirect methods, which, if not so reliable, yield approximate results in cases where the direct methods are not applicable. From the distances, which are often expressed in **LIGHT YEARS**, and the apparent brightness as measured photometrically, it is then possible to calculate the real, intrinsic luminosity of the stars. These are expressed as **ABSOLUTE MAGNITUDE**, and it is found that the stars range in real brightness from more than 25,000 times more luminous than the sun to more than 25,000 times fainter than the sun. Statistical investigations making use of the distances and absolute magnitudes thus far determined have yielded estimates for the number of stars in space, as well as for the relative frequency

of bright and faint stars. Two of these conclusions may be mentioned. It appears that in the neighborhood of the sun a space of 10,000 cubic light years contains on the average about 15 stars. More than half the stars in space are less luminous, intrinsically, than the sun.

From a comparison of the brightness of a star as observed by the eye, with that obtained from a photographic plate which is sensitive to blue but not to yellow light, a measure is obtained for the color of the star. By analysis of the light of the stars with a spectroscope, **STELLAR SPECTRA** may be obtained; these may be classified into a number of groups. It is found that, with only a few exceptions, the half million or so stellar spectra so far observed may be ranged according to the lines they show in a continuous sequence. It has also been abundantly proved that this is at the same time a sequence of colors. The different classes of stellar spectra are designated by means of letters of the alphabet, where the earlier letters such as B and A indicate the hotter stars which are blue or white in color and possess surface temperatures from 15,000° to 40,000° F.; the letters F, G, and K indicate the stars somewhat similar to the sun, yellowish in color, and having surface temperatures around 7,000° to 13,000° F.; while the later letters, M, N, R, and S denote the redder and cooler stars with temperatures of about 3,000° to 5,000° F.

**Dwarf and Giant Stars.** A definite relation has been found between the temperature of a star and the intrinsic luminosity. Of the very hot blue and white stars the luminosity of the B and A stars averages, respectively, 1,000 and 40 times that of the sun. As the color becomes more yellow, and the temperature decreases, it appears that a star may belong to one of two different groups as far as its luminosity is concerned. For the first of these groups the intrinsic brightness averages around 100 times that of the sun, regardless of the color of the stars; while for the second group this average value decreases from about 10 times brighter than the sun for stars of spectral class F to less than 0.0001 of that of the sun for stars of spectral class M. This second sequence contains by far the largest portion of the stars in the universe, and is therefore often called the main sequence. The stars belonging to it are often named **DWARFS**, a term signifying principally a feeble luminosity. The sun, whose spectral class is G is a typical star of this group, and belongs to the yellow dwarfs. The stars belonging to the first group, and having an average luminosity 100 times that of the sun, as well as the very luminous white and blue stars are generally called **GIANTS**.

Another statistical relation which has been established is that between mass and luminosity. The brightest stars are the most massive. This relation is so well established that it provides an estimate of the mass of a star as soon as its luminosity is known.

The terms giant and dwarf have, therefore, more than one significance. The giants prove to be, on the whole, very massive stars, exceeding the sun up to 100

times in mass. The dwarfs have less mass, the fainter and redder ones being no more than one-twentieth as massive as the sun. There is between the giants and dwarfs still greater disparity in size. It has been shown by observation of ECLIPSING BINARIES, and by direct measurement with the interferometer of some of the red and yellow giants, that whereas the dwarfs are all more or less comparable in size to the sun, the giants range up to 500 times the sun's diameter, and in bulk may surpass the sun more than 100 million times. When the small difference in mass is considered in connection with the large range in bulk it is seen that there is a great difference in density. The dwarfs are again comparable with the sun with a density range between that of water and that of the earth. The giants are much more tenuous, the larger ones possessing densities of less than one-thousandth that of ordinary atmospheric air.

A few stars are known which form an exception to these general rules. The most outstanding among them are the so-called WHITE DWARFS, stars of very high temperatures, comparable in mass to the sun, but of feeble luminosity and exceedingly small size. Calculation and observation have shown that some of these stars are smaller than the earth, and have an average density up to 100,000 times that of water, representing a mass of more than one ton per cubic inch. Although inconceivable on earth, such high density has been proved by atomic physics to be quite within the realm of possibilities at the high temperatures of the stars. Very few of these stars are now known. We must realize, however, that only the very nearest of them can be observed because of their very feeble luminosity. It may be that actually they are very numerous.

In addition to these outward characteristics of the stars it has become possible, in recent years, to investigate by theoretical means the conditions existing in stellar interiors, and it has been estimated that regardless of the surface temperatures of the stars their interiors should all be at approximately the same temperature of about  $70,000,000^{\circ}$  F. Furthermore, the density in the central parts of a star must be much greater than that near the surface. It has been estimated that pressures up to 10,000,000,000 atmospheres may exist in these stellar interiors. Further astrophysical researches have given indications concerning the outward decrease in pressure in the atmospheres of the stars, the depths to which our observation can penetrate into them, the relative abundance of the various chemical elements, and the electrical conditions prevailing on their surfaces.

**Stellar Evolution Theories.** Similar theoretical analysis has afforded some clues concerning the age of the stars, the evolution they go through in the course of their life, and the source of their tremendous energy output. It has thus been concluded that the age of the sun and the stars should probably be counted in trillions of years, with the sun having run less than half its luminous course of existence. According to the theory of relativity, the colossal energy output of

the stars means that thereby the stars are also losing mass. The sun, for example, which is continually radiating away the stupendous amount of something like 500,000,000,000,000,000,000 horse-power, is thus losing mass at the rate of 150,000,000,000,000 tons per year. To account for this continuous and seemingly inexhaustible supply of energy, various theories have been advanced; but at the present time the only one which seems at all tenable is that which supposes this energy to be derived from an internal subatomic process. To explain the various stages of stellar development which are apparent to us in the universe, as well as the relative number of stars belonging to these various stages, that is, to explain the process known as stellar evolution, a number of theories have been advanced, and although not one of them is free from major difficulties, and even apparent contradictions, it would seem indicated that at least one of the stages in the life history of a star is the gradual advance along the main sequence. The advance of a star along this sequence, from type B to type M, involves a gradual dissipation of energy, a decrease in mass, and a decline in luminosity. The question of stellar evolution, however, is still far from a satisfactory solution.

The motions of the stars can be observed partly as PROPER MOTION, that is, as an apparent angular displacement in the sky, partly as RADIAL VELOCITY, that is, as a motion in the line of sight. The first is measured by comparing the positions of the stars determined at two widely different epochs, or by directly superposing two photographic plates of the same region of the sky which have been taken at different times. The latter is measured with the spectroscope directly in miles per second. It may be either a velocity of approach or one of recession. Since the proper motion is observed in angular measure, a knowledge of the distance of the star is necessary before its proper motion can be converted into linear measure, i.e., into miles per second. The total, or space velocity of the stars may range from practically zero to nearly 1,000 miles per second, but the average probably lies in the neighborhood of 20 to 30 miles per second.

Analysis of the motions thus obtained has brought out the fact that they are not haphazard. A large part of the motion can be explained by the reasonable assumption that the sun also is moving in space and that, therefore, part of the observed stellar motions is simply a reflex of the solar motion. The sun is apparently moving toward a point in the sky not far from the bright star Vega, with a speed of about 18 miles per second. After allowance has been made for this effect, it is seen that there exist several preferential directions in which the stars seem to move. Furthermore, the stars of high velocity appear to form a group distinct from those of low velocity. The stars appear to be grouped in swarms, all revolving around some common center but at different distances and with different speeds. When once all these systematic drift-motions have been accounted for, it appears that the



remaining, individual velocities of the stars are, indeed, haphazard in direction, and in speed, to such an extent that the motions of the stars in the universe may well be compared to that of the molecules in a gas.

**Double-Star Systems.** Study of double-star systems has led to very interesting results, including the determination of the individual masses of the stars by comparing the periods of revolution, and the mutual distances of the components of such a binary system with analogous data in the solar system. The spectroscope has revealed the existence of many double stars where the components are too close to be separately visible in a telescope. Detailed study of the characteristics of such a SPECTROSCOPIC BINARY has given valuable information concerning the masses of the components, and their rotation on an axis, as well as about the probability of the origin of such a system by fission of a single, large, but unstable star. Some spectroscopically double stars belong to the category of eclipsing binaries. In such a double-star system the orbit lies nearly edge on as seen from the earth, and each of the components regularly passes in front of the other and partially or totally eclipses it. The star as a whole grows dim. The changing brightness is measured with a photometer until the LIGHT CURVE can be accurately plotted. From the shape of the curve it is possible to calculate the diameters of the two stars relative to each other and to their distance apart, their relative brightness, their departure from a spherical form and their densities.

Real VARIABLE STARS are those stars whose variations in brightness are produced by causes inherent in the stars themselves. Several classes may be distinguished, according to whether the light variations are regular or irregular in nature. The most regular are those known as Cepheids and Cluster-Variables, which are exceedingly luminous stars. Their light variations appear to be caused by pulsations. These studies have led to the establishment of an important relation between the luminosities of such stars and their periods of variation. The period is easily observed, likewise the apparent brightness. The latter depends on distance as well as on real brightness. Now if one knows that a period of 10 days corresponds to a luminosity 580 times that of the sun he can deduce the distance. This method has been of great value in determining the distances of island universes. There are a great many variable stars among the red ones. Many of them are roughly periodic in 200 to 400 days. Others are entirely irregular in their behavior. It will be readily grasped that the problem of the true nature and cause of variability of such stars is a peculiarly difficult one.

NOVAE, or new stars, are those in which, as now appears probable, some violent internal disturbance causes a tremendous, and exceedingly rapid increase in brightness amounting, sometimes, to as much as a millionfold in one day. After having reached their climax they then fade again slowly, and with marked fluctuations of brightness, and usually return to their

original brightness in from 10 to 20 years. They are usually called moving clusters. If such groups of stars are far enough distant for their connection to become at once evident by apparent propinquity in the sky, they are called STAR CLUSTERS. The PLEIADES form an example. Clusters consisting of large numbers of stars, packed closely together in the center and thinning out toward the edges, are termed globular clusters. They are generally vast aggregations of tens of thousands of stars many of them more luminous than the sun. Their distances run to 100,000 light years or more, and their study has led to an entirely new conception of the structure of the universe.

Next to the star clusters come the NEBULAE, great irregularly outlined and ill-defined clouds in space, some of them luminous, others dark, and opaque. The latter are recognized by their power to obscure the light of the stars behind them, and are apparent to us simply as regions of the sky in which we see relatively few stars. It follows from recent researches that this dark appearance is, so to speak, the normal condition of extended nebulosity and that the luminous nebulae shine either by reflected starlight, or because the starlight falling on them causes the particles of gas in the nebulae to emit light of their own. From the peculiar green color of this light it has been possible to conclude that they consist largely of an extremely rarefied mixture of oxygen and nitrogen. Some nebulae appear in the form of hazy, circular disks. These are known as planetary nebulae.

**Milky Way System.** All the objects enumerated thus far form an integral part of that great aggregation known as the Milky Way system, which, as seems most probable at present, is shaped in the form of a flattened disk some 300,000 light years in diameter. The sun, apparently, is located some 50,000 light years from the center of the system. It is estimated that the Milky Way system contains in the neighborhood of 10 billion stars, numerous star clusters and nebulae, while around the edge of the disk-shaped structure may be found several dense conglomerations of stars, generally called star clouds. It is these clouds which form the most conspicuous part of the Milky Way as we see it in the sky.

The Milky Way, or Galactic System as it is often called, does not comprise the whole of the material universe as was once thought to be the case. On the contrary, the dimensions of the Milky Way system are insignificantly small as compared to the extent to which even at the present time our largest telescopes have explored space. It is now clear that outside the Galactic System there is a very large number of systems or aggregations of stars, some of which are similar in shape and structure to the Milky Way itself. From their position beyond the Milky Way they are called extra-galactic nebulae. Most of them are small, faint, nebulous objects brought to light only by long photographic exposure. Many of them are elliptical in form. From the distinct spiral appearance of the brightest and nearest, e.g., the great Andromeda Nebula, they are called SPIRAL NEBULAE. Apart from

two or three comparatively small objects, which are at a distance of only a few hundred thousand light years, and may possibly form a part of the Greater Milky Way system, the distances to these extra-galactic objects are measured in millions and hundreds of millions of light years. Their dimensions seem to vary from 10,000 to around 50,000 light years in diameter for the very largest. They are, therefore, in the vast majority, considerably smaller in size than our galactic system. In other respects, however, they have many points in common with our system, sufficient to justify the supposition that they are, indeed, external galaxies. In several parts of the sky aggregations of these island universes have been found, which have been given the collective designation of super-galaxies. It appears not improbable that it is not the individual extra-galactic nebula which is directly comparable to our gigantic Milky Way system, but rather the collective gathering of a super-galaxy. The various forms under which these external galaxies appear can be classified into different groups which then seem to form a definite sequence also, and it has become fairly probable that this sequence represents at the same time the course of development of such objects. In the early stage they would still be gaseous. Gradually their rapid rotation flattens them out until they become unstable, and matter is thrown off at the circumference. Ultimately condensations form and separate stars develop both in the matter thrown off, and in the remaining central core itself.

Observations with the spectroscope indicate that these island universes possess enormous velocities, ranging up to nearly 20,000 miles per second, while furthermore the curious fact has come to light that with the exception of two of the nearest, they are all receding. Their speeds appear to increase proportionally with their distance from us. This has been interpreted not as real motion, but as corroboration for the curved space of relativity. According to this theory such apparent recessional velocities must exist. From the observed values it has then become possible to calculate the radius of this curved, finite, but limitless space of relativity and a value of 2,000,000,000,000 light years has been estimated for it. C. J.; W. J. L.

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**ASUNCION**, the capital and port of Paraguay, situated on the Paraguay River, 1,000 mi. from Buenos Aires. It is regularly reached by large steamers. The city is built largely on the bay which extends eastward from the river. Among the buildings of interest are the cathedral, the government palace, the municipal palace and several imposing business structures. The water front is the meeting point of the large steamers that ply up and down the Paraguay and its tributaries; lighter draft vessels operate from Asuncion to inland river ports. Buenos Aires traffic for the interior is trans-shipped at Asuncion.

The mean temperature varies between 71° and 73° F. The maximum has reached 105° F., but there are many years when the heat does not register more than 98° F. Pop. 1928, 142,300.

**ASYLUM**, a practice of both Biblical and Greek times, which allowed the offering of sanctuary to political refugees, persons accused of crime, slaves and others who sought the protection of a foreign state within its legations, consulates, warships, and in some cases even on its merchant-vessels. A state, in the absence of a treaty may give sanctuary to as many foreign fugitives as it likes. It has been abandoned practically in Europe, and has little application even in Latin America and Asia where it once thrived.

**ASYLUM, RIGHT OF**, the right of a state to grant protection, but not the right of a fugitive in a foreign land to demand protection. It is an act of sovereignty which, in modern time, is rarely insisted upon. It is generally claimed by countries for their Nationals. Insurgents and refugees in the legations and consulates of South American countries claim protection.

**AS YOU LIKE IT**, a sylvan comedy by Shakespeare (written about 1600; first folio published 1623), based largely on Lodge's romance, *Rosalynde*. This idyllic comedy, swiftly moving, always graceful, is set in the romantic forest of Arden. It is full of woodland lovers and banished dukes, of intrigues, plots and disguises, of melancholy and fine wit. The chief characters are Rosalind, the beautiful, clever daughter of the banished duke, and Celia, her equally fair cousin (the two heroines go in disguise, Rosalind as a shepherd, Celia as her sister); Orlando, who is in love with Rosalind, and his elder brother, Oliver, in love with Celia; the clownish Touchstone and his rural love, Audrey; and, lastly, the unforgettable, melancholy Jaques. The play ends happily for all concerned—the banished duke restored to his dominions, the lovers in each others' arms. In the opinion of many critics the comedy is Shakespeare's finest.

**ATAHUALPA** (c. 1500-1533), Sovereign of Peru, and last of the Incas, was born probably at Cuzco, about 1500. His father, Huayna Capac, on his deathbed in 1525 made Atahualpa King of Quito, leaving to his half-brother, Huascar, the rightful heir, the remainder of the empire of Peru. In the inevitable struggle for supremacy Huascar was finally defeated in 1532. When the Spaniards in the same year invaded Peru, under Pizarro, they were able to take advantage of this internal dissension, to achieve the conquest of the country. Atahualpa's refusal to acknowledge the King of Spain as master, and to embrace the Christian religion resulted in a massacre of the Peruvians and the imprisonment of the Inca. Although he raised an enormous fortune as ransom, he was, after a mock trial, condemned to death, and executed on Aug. 29, 1533.

**ATALANTA.** See ATLANTA.

**ATALI**, meaning Mountain or Upper, one of the three dialectic groups of the CHEROKEE Indians, a southeastern group forming a division of the Iroquois

linguistic stock. The Atali together with the Cherokee lived in northern Georgia, eastern Tennessee and western North Carolina.

**ATAMASCO LILY** (*Zephyranthes Atamasco*), a handsome, spring-flowering bulbous plant of the *AMARYLLIS* family found wild in moist soil from Pennsylvania to Alabama and Florida, and readily cultivated as a pot or border ornamental. The narrow, grass-like leaves, about a foot long, borne on a short hollow stem, appear at the same time as the single pure white or purple-tinged lily-like flower.

**ATAVISM**, in biology, a "throw-back" or recurrence of an earlier evolutionary form or trait. Frequently the term is employed in a loose sense without special connotation of the limits within which such a phenomenon may occur. Some writers make a distinction between reversion and atavism. They define reversion as the reappearance of a character after one or two generations and atavism as the presence of a trait characteristic of a more primitive organism in the same evolutionary line. An example of an atavism is the rare appearance of horizontal leg markings in highly developed and domesticated horses. The vestigial and cartilaginous tail occasionally found in man may also be called atavistic.

Many cases of reversion may be accounted for by genetic laws. The mating of two heterozygous individuals would permit the reappearance of a recessive character. So-called atavisms are sometimes developmental anomalies.

The concept of atavism was used by Cesare Lombroso to account for criminal types. He considered the criminal as an atavistic representative of a more primitive and brutal type of man. H. L. S.

**ATBARA**, a river in northeastern Africa, a tributary of the *NILE*. It rises near Lake Tsana or Dembea and flows in a northwestern direction, reaching the Nile about 25 mi. from Berber after traversing a course of close to 1,000 mi. The river is not navigable.

**ATCHISON**, a city in northeastern Kansas, the county seat of Atchison Co., situated on the Missouri River, 22 mi. southwest of St. Joseph, Mo. Four railroads, bus lines and river craft make the city a shipping point for grain, fruit and vegetables grown in the region, and for the city's industrial output. There is an airport. The local manufactures are flour, wire goods, dairy products, locomotives, stationery, drugs and other products. In 1929 the factory output reached about \$17,000,000; the retail trade amounted to \$7,735,692. Founded by anti-Abolitionists in 1854, the city was incorporated in 1858. Here the Santa Fé Railroad was organized. Atchison is the birthplace of E. W. Howe, the editor, and Amelia Earhart, the aviatrix. It is the seat of St. Benedict's College. Atchison is governed under the commission-manager plan. Pop. 1920, 12,630; 1930, 13,024.

**ATFALATI**, an American Indian group belonging to the Kalapooian linguistic stock. They lived in the environs of Wappato Lake in Oregon and early in the present century were segregated on the Grande

Ronde Reservation in Oregon. Little is known of their aboriginal culture which the Atfalati abandoned long ago.

**ATHABASCA**, a river of Alberta, Canada, emptying into Lake Athabasca. The name is a Cree Indian word, meaning "where there are reeds." Reeds grow in great profusion in the muddy deltas of the river and the rich soil shallows of the lake. The river rises on the eastern slopes of the Rocky Mountains near Yellowhead pass, and has a course of about 740 mi. in a northeastern direction. The Clearwater, McLeod, Lesser Slave and Pembina are the most important tributaries.

**ATHABASCA, LAKE**, a body of water situated in west central Canada, partly in Alberta and partly in Saskatchewan. It lies to the extreme north of these provinces in 59° N. lat., between 106° and 110° W. long., and its surface is 697 ft. above sea level. The elongated shape of the lake gives it a length east to west of 195 mi. and a width varying from 5 to 35 mi. Its surface area measures 2,842 sq. mi. At the western end the lake is shallow but is deep elsewhere and is navigable throughout. Near its southwest extremity it receives the Athabasca River and from its northern shore it discharges into the Slave River. The surrounding country is generally rocky and unfit for agriculture but abounds in wild game, and the lake supplies quantities of fish. Fort Chippewyan, one of the oldest and still an important northern fur-trading post, is situated on the north side of the lake.

**ATHANASIAN CREED**, a resonant formula beginning with Latin words, *Quicumque vult*. Authorship by ATHANASIUS is improbable; but the creed is an expression, highly elaborated and controversial, of the NICENE view of "one God in Trinity and Trinity in Unity, neither confounding the Persons nor dividing the Substance" which was maintained by orthodoxy against Arian (see *ARIANISM*) SABELLIANS, MONOPHYSITE and other heresies. The creed is included for recitation on certain Sundays in the Roman Catholic BREVARY, but in the order of the Greek Church, it is printed, not read. In the first English Prayer Book, 1549, it is to be read on six festivals, CHRISTMAS, EPIPHANY, EASTER, ASCENSION, PENTECOST and TRINITY. In 1552 seven saints' days were added, making 13 in all. But the so-called damnatory clauses have aroused protest. In 1785 the General Convention called to draft a constitution for the PROTESTANT EPISCOPAL CHURCH in the United States proposed to omit the Nicene and Athanasian creeds from her PRAYER BOOK; but on the advice of the English Archbishops of York and Canterbury the Nicene Creed was retained, though the Athanasian was dropped. In the Revised Prayer Book of the Church of England, the use of the Athanasian Creed, either as a whole or in specified parts, is made optional.

**ATHANASIUS, ST.** (c. 298-373), sometimes called "The Great," one of the Church Fathers, was born about 298, presumably at Alexandria. The boy was seen on the shore baptizing other boys in true canonical fashion and Alexander, the bishop, was so

impressed that he took Athanasius into his household. In stature he was insignificant, but he had rich auburn hair and from the first his genius, piety, erudition, evangelical zeal and self-discipline made an ineffaceable impression. He was in touch with the Ascetics (see ASCETICISM) of Egypt who dwelt in the desert; and St. Anthony, the hermit, when dying bequeathed to him a garment and a sheepskin. In 313, when Athanasius had reached his fifteenth year, Constantine was converted to Christianity and a questionable temporal patronage was brought to bear on the Church. Athanasius became the outstanding champion of orthodoxy against all subverting influences, *Athanasius contra mundum*, and in Alexandria he encountered Arius, known as the heresiarch. (See ARIANISM.)

In 325, Athanasius accompanied his bishop to the Council of Nicaea where, though a deacon only, he achieved victory over Arius, who was condemned. In 326 Athanasius succeeded Alexander as patriarch of Egypt. After discussions with Arius, the view of Constantine was that the struggle concerned words only, and Athanasius was ordered to accept a recantation by Arius and to restore him to the ministry. The patriarch steadily refused and the controversy was greatly exacerbated. Athanasius was accused of murdering a bishop called Arsenius, and of cutting off his hand and keeping it for magical purposes in the monastery of the Thebaid. Also he was charged with whipping or imprisoning six other bishops. At the Council of Tyre (335), the hand was produced in a wooden box, but Arsenius also was discovered and from his cloak produced both his hands. So great was the bitterness that Athanasius was accused of sorcery. A charge of immorality was disproved. A woman brought forward by the Arians was completely discredited by her failure to know Athanasius by sight. The patriarch was deposed, however, Arsenius adding his signature to the sentence with the hand which Athanasius was supposed to have cut off.

Athanasius proceeded to Constantinople and obtained the emperor's attention by flinging himself before Constantine's advancing horse. But he was accused next of obstructing the overseas corn trade between Alexandria and Constantinople, and in 336 a synod of Jerusalem confirmed the sentence against him. He was banished to Treves where he remained in comfort for 28 months. In 337 Constantine died and Athanasius resumed his office at Alexandria, so challenging the verdicts pronounced against him. Of the late emperor's three sons, Constantine II and Constans favored the Nicenes, while Constantius, ruling the East, was an Arian. Hence Athanasius was driven from Alexandria where, with much bloodshed and outrage, an Arian, Gregory, was installed in his place. He fled to Rome, and here, in 340, a council of Western bishops summoned by Pope Julius acquitted him. In 341, however, an Arian council at Antioch confirmed his deposition. In 343 yet another council at Sardica vindicated Athanasius, a collision of authority which disclosed the first hint of schism between the Greek and Latin churches. Athanasius then returned

to the patriarchate. The Arians were still active. After the murder of Constans, their patron Constantius became sole emperor. The Western bishops, themselves meeting at Arles in 353 and at Milan in 355, were induced by corrupt methods to condemn Athanasius and his friends, including St. Hilary.

In 356, Athanasius was conducting a service in the Church of St. Theonas when 5,000 troops led by Syrianus, Duke of Egypt, burst in, and a reign of terror began in which pagan and Arian joined hands in outrages, sparing neither age, sex nor property. George of Cappadocia was installed as patriarch with evil results. For six years Athanasius lived as a fugitive, usually among the Thebaid monks. Once his refuge was a cistern which he left just before an attempt by a slave-girl to betray him, and for a period an exquisite lady, only 20 years of age, shielded him with pure devotion. During this period the heretical Council of Sirmium (357) issued the creed called the "Blasphemy," and when Constantius died in 361 his successor was JULIAN the Apostate. Under the toleration of his earlier years, Athanasius returned to Alexandria, which city had been driven into revolt by the oppression of George of Cappadocia. Athanasius again resumed the patriarchate but later was driven out into his fourth exile by Julian. In 363 Julian was succeeded as emperor by Jovian. Athanasius was recalled, a now venerable figure, but in 364 Valens ascended the throne and for the fifth time the persecution was renewed. Athanasius had to take refuge in the tomb of his father, where his concealment lasted four months. His influence in Egypt was necessary to peace and he was allowed to return to his office. He died in 373, and while at that day his victory was not complete, in a few years Arianism with its virtually discordant theories was disintegrated, and the orthodox position established. P. W. W.

**ATHAPASCAN**, a widely distributed Indian linguistic stock found in three distinct areas, northern, Pacific and southwestern, on the North American continent. Despite wide geographical distribution the languages composing the Athapaskan family are plainly related and, because of certain peculiarities, stand out distinctly from other American speech groups. The northern division inhabited the drainage of the Mackenzie, the Yukon and the upper Frazer rivers, a vast territory comprising practically all of the interior of Alaska and of western Canada. They practised no agriculture but were skilled hunters of the moose, caribou and deer, used houses, vessels and clothing of skin, and were organized into small bands with simple social and political organization. The principal tribes are the Khotana on the lower Yukon and Cook inlet; the Kutchin on the middle Yukon and eastward to the lower Mackenzie; the Nahane on the upper Yukon; the Sekani on the upper Frazer and Peace rivers; the Beaver, Dogrib, Chipewyan, Hare, Slavey and Yellowknife in the Mackenzie drainage, and the Sarsi on the plains to the south. They probably did not exceed 30,000 Indians.

The Pacific Coast division, which has practically

disappeared, consisted of one tribe in the interior of British Columbia, two in Washington and occupied almost continuously a strip of 400 miles between the coast and Coast Range mountains from the Umpqua river in Oregon to the Eel River in California. Culture and dialects in this region varied widely. Among the principal dialect groups are the Coquille, Tututni, Chastacosta, Umpqua and Chetco in Oregon; and the Tolowa, Hupa, Chilula, Whilkut, Mattole, Nongatl, Lassik, Wailaki, Sinkyone and Kato in California. This division has been estimated to number 20,000.

The southwestern division comprises most of Arizona and New Mexico, southern portions of Utah and Colorado, the western borders of Kansas and Texas, and it extended into Mexico. Language and culture of this division are quite uniform. It has three groups, the Lipan, formerly of western Texas but now living with the Mescalero in New Mexico; the Navajo, south of the San Juan river in north-eastern Arizona and northwestern New Mexico; and the various Apache groups, Jicarillo, Mescalero, San Carlos and White Mountain living to the west, south and east of the Navajo. The three major linguistic divisions of the Athapaskan family display distinct differences in physical type and culture traits, pointing to a considerable antiquity in their separation from one another.

**ATHEISM**, strictly defined, means a denial that any Supreme Being exists. To quote the final address of ROBERT INGERSOLL, delivered in Hollis Street Theater, Boston, on June 2, 1899:

Nature has no master. If matter and force are from and to eternity, it follows as a necessity that no God exists; that no God created or governs the universe; that no God exists who answers prayer; no God who succors the oppressed; no God who pities the sufferings of innocence; no God who cares for the slaves with scarred flesh, the mothers robbed of their babes; no God who rescues the tortured, and no God that saves a martyr from the flames.

In the United States, the American Association for the Advancement of Atheism, with headquarters in New York, has promulgated these views. On the other hand, much so-called atheism is rather to be described as Anti-Clericalism. Even TOM PAINE has left a pamphlet entitled *Atheism Refuted in a Discourse to Prove the Existence of God*, and H. G. Wells has written a book, *God, the Invisible King*, which differentiates him from the atheist cult.

The denial of God means, of course, the denial of that conception of God, frequently distorted, which is current at the time. According to Plato, the philosopher Socrates was alleged by the Athenians of his day, to be an atheist, and Cicero brought the same charge against the philosopher Diagoras. The early Christians, when they refused to worship the Pagan deities, were denounced as atheists. But the number of persons who accept the atheist view with all its logical implications, has never been large. Recently,

the cult has gained an international importance owing to its adoption by the Communist Party dominant in Russia. See BOLSHIEVISM; AGNOSTICISM; RATIONALISM.

**ATHENA**, the Greek goddess of wisdom, called by the Romans MINERVA. Amid the medley of Greek myths Athena stands out as the unsullied symbol of power and wisdom. She sprang from the head of ZEUS, and innumerable local legends gathered around her person. Broadly, she represented ethical qualities as distinct from the powers of nature, and she was thus the supreme protectress of the civilized state. She watched over national defenses like fortresses, walls and harbors. Unlike ARES or MARS, the god of war, Athena took no pleasure in bloodshed but regarded hostilities only as an instrument of statesmanship. Frequently she appeared without weapons. When she needed them, she had to borrow from Zeus. The goddess developed agriculture, and when the Greeks proposed that their leading city should be named after the divinity who granted the greatest blessing, Athena won the honor with her olive tree against POSEIDON who offered only the horse; hence the name, Athens. She taught the people to yoke oxen to the plough, to breed horses, and to tame them by the bridle which, like the chariot, was her own invention. Also she invented numbers, navigation of ships and instruments of music, for instance, the trumpet. Her idea of a flute was derived from the hissing of serpents around the head of MEDUSA.

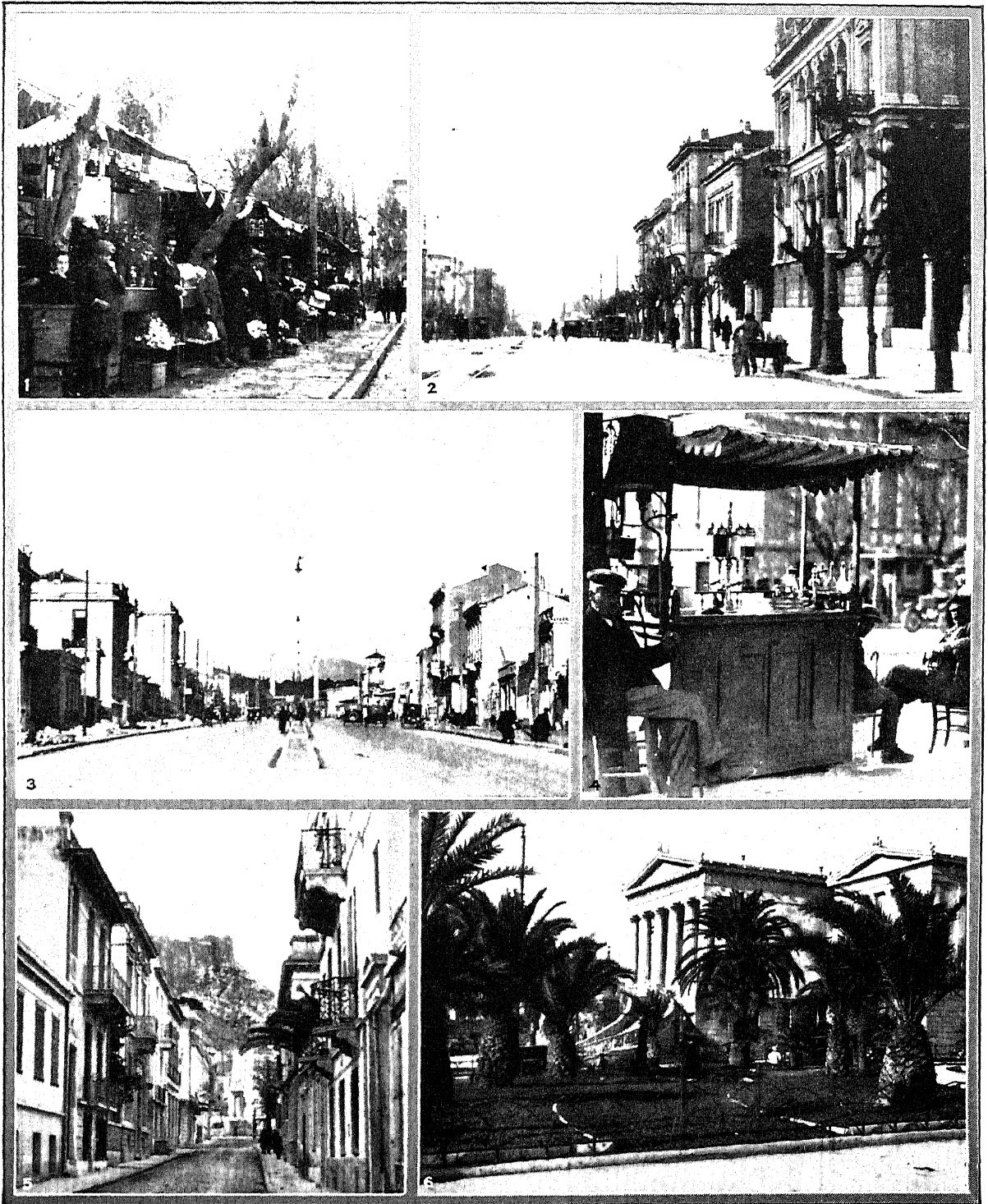
Athena maintained the authority of law, and was herself an exemplar of modest restraint. Unlike other divinities, Athena is represented fully clothed. In her original character, she was a virgin. Usually she wore a helmet with an AEGIS, a round shield with the head of Medusa and vestments. Objects sacred to her were an olive branch, serpent, owl, cock and lance. The goddess was known as Pallas, which is frequently used by Homer.

**ATHENAGORAS**, early Christian philosopher who lived in the second half of the 2nd century, is believed to have been a native of Athens. Little is known of his life. His principal extant work is the *Apology*, or *Embassy for the Christians*, which defends the Christians against the accusations of atheism and cannibalism; its date is fixed at 176 or 177. Athenagoras's work, greatly influenced by the Platonist philosophy, has a clear and forceful style.

**ATHENIAN CONSTITUTION**, the most democratic constitution of ancient Greece. It developed from a monarchy, which became an aristocracy after the towns of Attica were incorporated with the city of Athens as one city-state, 7th century B.C. The kingship survived in the office of king archon, which became a priesthood; a polemarch, who commanded the army, and an archon, or civil executive, formed with him the first rulers of the community, to which were later added six thesmothetae. All these magistracies were at first permanent, but later limited to a single year. A council called the Areopagus, constituted from elders, exercised judicial functions. The



# ATHENS



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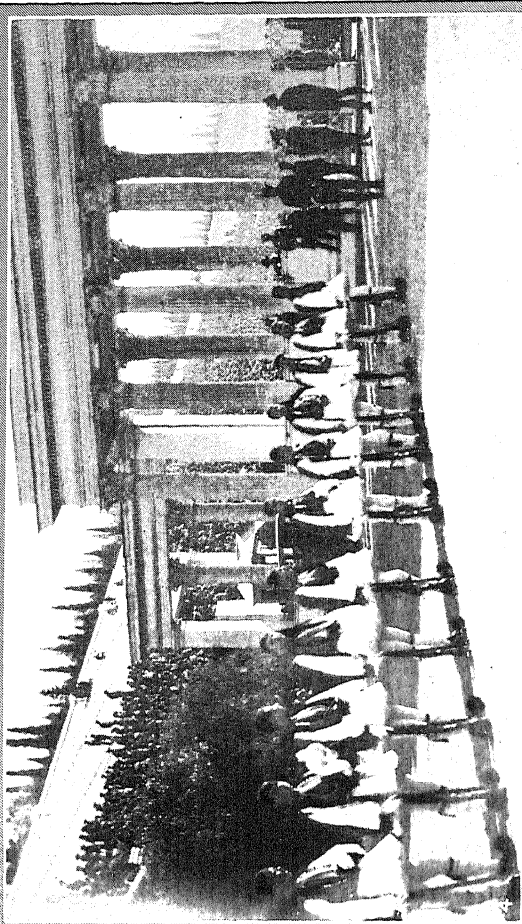
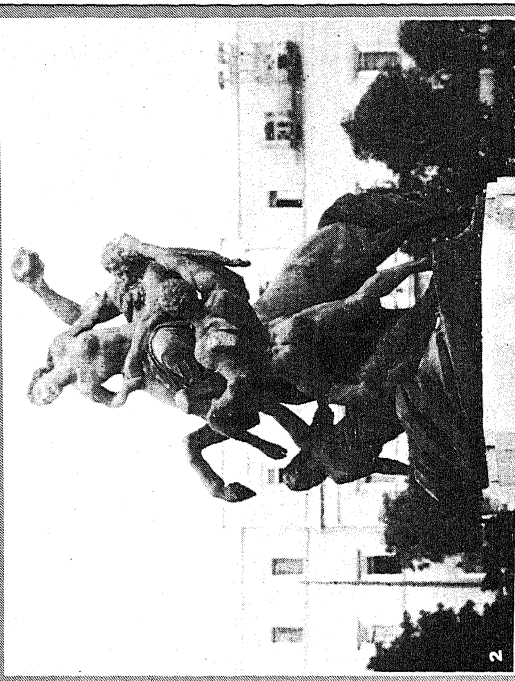
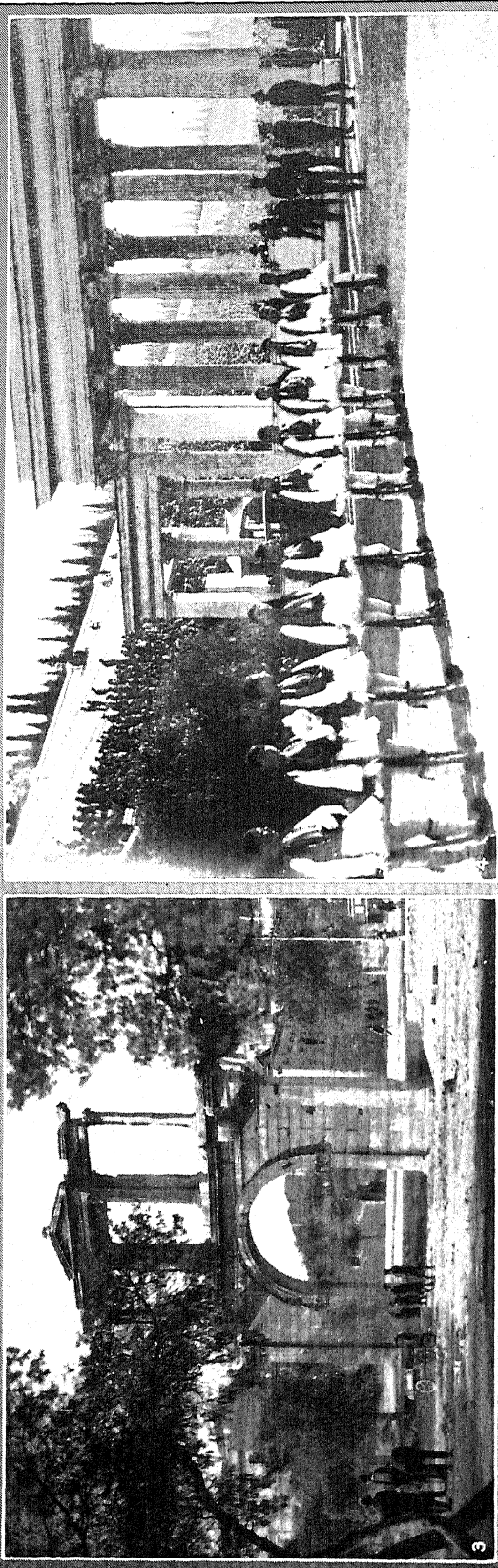
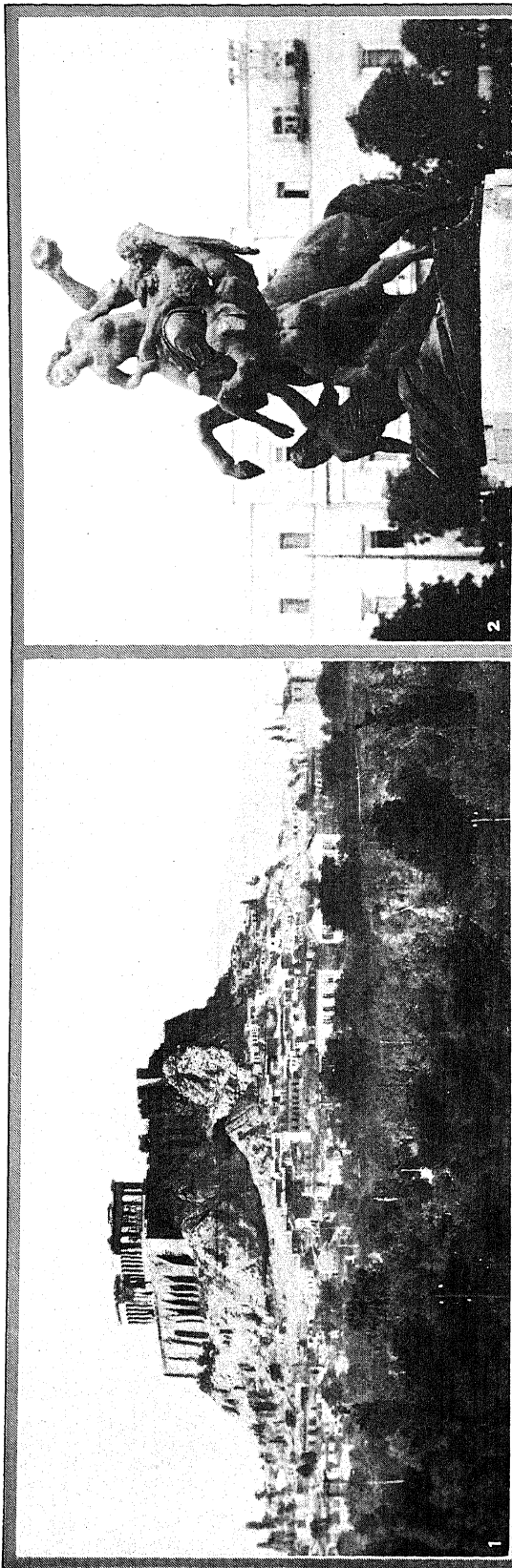
## SCENES IN MODERN ATHENS

1. Flower vendors' stands near the old palace. 2. University Street showing the Schliemann House presented to the Greek Government for a museum. 3. Boulevard leading to the Bay of Phaleron. 4. Soda fountain, Athenian style, in

University Street. 5. Street leading from the Arch of Hadrian. Part of the Acropolis appears in the background above the houses. 6. National Library with its Doric colonnade of marble from Mt. Pentelicus.



# ATHENS



## ATHENS, ANCIENT AND MODERN

1. The Acropolis seen from the stadium.
2. Statuary group in Constitution Square of a centaur attempting abduction of a Lapith woman.
3. Arch of Hadrian, marking the entrance to the City of Hadrian.
4. The Evzones, bodyguard of the president of Greece, in full regalia.

democratic element, which later prevailed, was found in the *ecclesia*, or assembly, which passed laws, elected magistrates, and decided war or peace. It was formed of the upper three or four classes into which citizens were divided according to wealth.

All this was changed when, in 594 B.C., Solon reconstituted the state. To the *Areopagus* was added the *heliaea*, a law court composed of citizens chosen by lot. The *bule*, a new council of 400, was created to prepare business for the *ecclesia*; and the latter now included all citizens. Cleisthenes, in 502 B.C., continued the reform toward democracy by radical innovations. He discarded the old classifications, and created electoral units of even geographical distribution, forming 10 tribes. Besides electing their own generals, who replaced the polemarch, these tribes were the basis of voting in the *ecclesia*, and were each represented in the *bule*, now containing 500 members, by a panel of 50, which was called a *prytany*. The 10 *prytanies* had the presidency of the rule in order, one in each of the 10 months; and acts were dated by the names of the archon and the *prytanizing* tribe. This constitution, although suffering occasional violence, as when an oligarchy of Four Hundred was set up during the Peloponnesian War, or when Sparta maintained the Thirty Tyrants at its close, operated during the whole of the classical period.

**ATHENS**, the capital of Greece, situated on the southwest coast of Attica, 3 mi. from the sea. Athena, the Greek goddess of wisdom, gave her name to the city. Rising to the north of the circular plain on which the city stands is Mt. Parnes, to the northwest Mt. Pentelicon, to the east Mt. Hymettus and to the west Mt. Aegaleos.

**Ancient Athens.** The geographical situation of Athens was originally such as to satisfy the primitive requirements for sustenance and defensive shelter. Situated as it was on the Attic plain, the fertile soil assured the original settlement its cereals, olives, figs and grapes, as well as ample pasturage for the sheep and goats. Nature further provided security from land attack through the surrounding barrier of mountains, and the community's distance from the coast was sufficient to save it from the danger of unexpected maritime incursions. On the other hand, the three natural harbors of Piraeus, Zea and Munychia were sufficiently near to assure to Athens its growing maritime and commercial power and its ultimate political supremacy. The surrounding hills proved to be rich in the building material needful for the later lavishment in architectural construction, and the clear and invigorating climate stirred both physical and mental activities. A somewhat inadequate water supply necessitated the sinking of many wells, the storage of rain water in cisterns and the building of aqueducts.

Recent excavations have brought to light remains of prehistoric Athens of the Mycenaean period. These excavations disclose that the Acropolis, commanding as it does the Attic plain, was seized by the early Mycenaean rulers as the site for massive forti-

fications, of which some traces still remain. To the primitive aboriginal and non-Hellenic Pelasgians, however, is ascribed the encircling wall known as the Pelasgicum or the Enneapylon. Adjoining the latter structure was the Pynx, a double-terraced structure that is presumed to have been the site of worship of an ancient Pelasgian cult. The rock dwellings and tombs that incrust its surface are apparently of a somewhat later date. The *AREOPAGUS*, situated between the Acropolis and the Pynx, has many ancient historical associations but shows to-day few architectural traces of former centuries. In the archaic era following the Mycenaean age, the city expanded, especially to the northwest, taking in the area known as Ceramicus or Potter's Field. Further absorbing various portions of the north and northeast, the city gradually came to assume the characteristic circular shape that it exhibited in ancient times. Between the *Areopagus* and Ceramicus was located that important section of the city known as the *Agora* or market place. Here were gradually built the public buildings that housed the administrators and magistrates of the city, and the *Agora* was likewise the center of the commercial and civic life of ancient Athens. A fountain with nine jets, known as the *Enneacrunus*, is supposed to have been situated toward the extreme south of the *Agora*. Northwest of Ceramicus stood the famous academy where Plato taught; northeast of Ceramicus was located the *Lycium*, seat of Aristotle's teachings. Both of these noted institutions are said to have been erected in the age of the *Peisistratids*, 560-511 B.C. Excavations of the last two decades of the 19th century disclosed the magnificent structures erected on the Acropolis itself under the guiding hands of *Themistocles*, *Cimon* and *Pericles*. The most imposing structures on the Acropolis proper were of course the *Parthenon*, the *Erechtheum* and the *Propylea*. The *Propylea* was the great entrance hall of the Acropolis; the *Erechtheum* was the early Temple of Athena, and the noble *Parthenon* the chief temple of Athena on the Acropolis. The Walls of *Themistocles* were built round the city after the Persian departure and included two long parallel walls connecting the city with Piraeus.

**Modern Athens.** The modern city is the capital of the Greek Republic and of the nomarch of Attica. Its harbor, *PIRAEUS*, with which it is connected by a modern electric railway, is 5 mi. distant. Modern Athens presents a remarkable record of growth as an old world city. When in 1833 it was chosen as the capital of the newly-established kingdom of Greece, the city was a mere village. It was selected as the capital principally for historical reasons. The plan of the new city is largely the work of the German engineer *Schaubert*. Wide, well-paved boulevards flanked by impressive public and private buildings radiate from *Harmony Square*, the hub of Athens. Some of the most notable buildings are: the Royal Palace, finished in 1838, which is surrounded by beautiful gardens but is itself of undistinguished architecture; the

*Vouli*, or parliament building; the Palace of Justice; the National Museum in which are housed some of the greatest treasures of Greek art; the University; Polytechnic Institute and the cathedral and a number of other educational and religious edifices. Most of these buildings were built with state funds, but a great many of them were made possible by the contributions of wealthy Greeks.

The decades from 1910 to 1930 were particularly remarkable in Athens' growth. In 1912, through the defeat of Turkey by the allied Balkan countries, Greece doubled her territories and population and Athens assumed a front-rank position among Balkan capitals. It not only became a political center of great importance but also the banking, commercial and industrial center of a wide and scattered area. Piraeus, its port, which in 1833 was an obscure fishermen's village, became one of the world's busiest ports and the chief point of export and import for the Greek islands and the Greek mainland. The principal industries of Athens and Piraeus are shipbuilding, flour milling, brewing and distilling, soap making and carpet weaving. The last industry is of fairly recent development and in a growing state; it was started by the Greek refugees from Asia Minor who invaded Athens and the suburbs after 1922. There are also important cotton mills, potteries, tanneries and chemical works. The exports are chiefly tobacco, wine, cognac, marble, olives and olive oil, oranges, lemons and other fruits. The imports include grain, coal, machinery, automobiles and other vehicles and manufactured articles of all kinds.

Until very recently the lack of sufficient water supply was a real danger to the health and sanitation of the city. For the past five years, however, an American company has been working on new reservoirs and the city is now assured of a copious supply of good water. Other recent improvements include new docks at the Piraeus harbor, electric railways to the chief suburbs and the straightening and widening of important thoroughfares. Pop. 1928, 452,919.

**ATHENS**, a city and the county seat of Clarke Co., in northeast Georgia, situated on the Oconee River, 73 mi. northeast of Atlanta. Bus and truck lines and five railroads serve the city. There is an emergency landing field. Cotton, corn and dairy products chiefly are raised in the district. Athens is an industrial center manufacturing lumber and cotton seed oil products, principally textiles and knitted goods. In 1929 the factory output reached an approximate total of \$7,000,000; the retail trade amounted to \$9,667,355. The city was founded as the seat of the State university in 1801. The state normal school is also located here. Dr. Crawford W. Long, discoverer of anesthesia, once lived in Athens. The century-old white oak tree that "owns itself" and the land on which it stands, willed by its owner to possess itself forever, and also a unique double-barreled cannon are landmarks of Athens. Pop. 1920, 16,748; 1930, 18,192.

**ATHENS**, a city in southeastern Ohio, the county seat of Athens Co., situated on the Hocking River, 72

mi. southeast of Columbus. It is served by three railroads. Athens is surrounded by fruit, live stock and dairy farms. The local factories produce furniture, stoves, parquetry flooring, office systems and binding machines. Ohio University, then known as the American University, laid out its campus here in 1801, when this site was a virgin forest. Waterloo State Forest is in the vicinity. Pop. 1920, 6,418; 1930, 7,252.

**ATHENS**, a city in southeastern Tennessee, the county seat of McMinn Co., situated 50 mi. northeast of Chattanooga. It is served by two railroads. The city is surrounded by good farming country and has cotton, wool, knitting and flour mills, foundries, packing houses and paper box factories. It is the seat of Wesleyan College. The Cherokee National Forest is easily reached from here. Athens was plotted in 1823 and incorporated in 1868. Pop. 1920, 2,580; 1930, 5,385.

**ATHERTON, GERTRUDE FRANKLIN** (1857- ), American novelist (née Gertrude Franklin Horn), was born in San Francisco, Cal., Oct. 30, 1857. She was educated at private schools in California and Kentucky. Mrs. Atherton's first novels, including *American Wives and English Husbands*, 1898, and *Ancestors*, 1907, have California for their background. Among her later stories are *Black Oxen*, 1923, *The Crystal Cup*, 1925, *The Jealous Gods*, 1928, and *Dido, Queen of Hearts*, 1929. In 1925 Mrs. Atherton was made a Chevalier of the Legion of Honor and in 1932 she published *Adventures of a Novelist*.

**ATHLETIC BUILDINGS.** As is the case with outdoor games (see **ATHLETIC FIELDS**), the facilities for indoor games (athletic buildings) are usually a regular part of the machinery of education, for both types of games fulfill educational as well as recreational purposes. Athletic buildings may include the covered tennis court, squash court, court tennis building, indoor swimming pool, riding rink, etc., of the club or of the individual owner; but the principal examples are the gymnasium, physical education building, field-house, field gymnasium, baseball cage and the locker building of the university or school. These buildings are principally used during the winter season and at other times when inclement weather renders outdoor play difficult or undesirable.

The facilities housed in modern athletic buildings may be divided into two classes: those concerned with play customarily, or necessarily, carried on indoors; and those concerned with play customarily carried on outdoors. The usual outdoor games require for their proper play very much larger clear areas, with higher headroom, than the usual indoor games, and it has been only comparatively recently, with the development of the larger field-houses or field gymnasiums, that the second class of facilities have become adequate for anything but restricted practice. Nowadays the familiar outdoor games of baseball, track and field, hockey, tennis, and sometimes football, soccer, lacrosse, can be played indoors with almost the same freedom from restriction as outdoors.

The term field-house requires some definition, as it is subject to different meanings in different parts of the country. In the East the term refers to a building housing principally dressing and bathing facilities for players of outdoor games, as lockers and showers. Typical examples are the Davis Field-house at Dartmouth, the Lapham Field-house at Yale and the Dillon Field-house at Harvard. In the West and South the term refers to a large building of the field gymnasium type, with its principal feature a large unobstructed room with a dirt floor, completely enclosed with steel, glass and masonry, and capable of being used for practice and play of a variety of different games. Important examples are the field-houses at Michigan, Iowa and Minnesota.

Athletic buildings of the outdoor class include not only field-houses, of both locker building and field gymnasium types, but also hockey rinks of natural or artificial ice; riding rinks, or indoor polo buildings; covered tennis courts and boat houses with rowing tanks and rowing machines. Those of the indoor class may include facilities for basketball, squash racquets, squash tennis, racquets, handball, boxing, wrestling, fencing, special or corrective exercises, swimming and diving; also locker-rooms; shower rooms; administration offices; facilities for doctors, trainers, coaches, managers and directors; and numerous service facilities such as laundry and equipment storage. A not inconsiderable feature, also, may be the provision for spectators, particularly at the basketball courts and the swimming pools. Various ingenious methods have been devised whereby the space in the building which is used for spectators at occasional contests may be made readily available for other purposes at other times. A building of this class is still commonly referred to as a Gymnasium, but more modern names are the Palestra at the University of Pennsylvania; the Physical Education Building at Rochester; the Indoor Athletic Building at Harvard, and the various commercial Colosseums or Gardens in the larger cities with their huge crowds of spectators and their multitudinous commercial uses, some athletic and some not.

G. H.

**ATHLETIC FIELDS.** Facilities for playing athletic games are found all over the world. In Great Britain, where a number of the modern games had their origin, such facilities have been familiar for generations. In Germany some cities, in carrying out their policy of *Grünfläche*, or open spaces, have developed *Sport- und Spielplätze* of great size. But nowhere has the development of athletic facilities been so general or so widespread as in the United States.

Athletic fields in the United States are with few exceptions built, owned and operated either by schools, colleges or universities, or by organized communities, usually municipalities or their agencies, as park commissions, school boards and recreation commissions. Social organizations, such as country clubs, provide facilities for a few of the specific games as golf, tennis or polo; but these, except for the very occasional facilities of an athletic club, are not generally included

under the designation athletic fields. Nor are the purely commercial facilities such as professional baseball parks properly included in the term, even though some of them may often be used by amateur players. Some occasional industrial organizations, such as manufacturing corporations, will provide athletic fields for their employees; but these are comparatively rare and are tending more and more to be displaced by community facilities.

The great majority of the users of athletic fields are those of school and college age, and, regardless of whether these facilities for playing athletic games are furnished by the community or the institution, they are generally regarded as a regular part of the machinery of education. This has resulted largely from a very general appreciation of obligation to the youth of the country to provide for their physical as well as their mental and moral development. The playing of popular games is recreation as well as physical education, and so these games have become the principal means of fulfilling recreational as well as educational purposes.

The increased interest of youth everywhere in the various athletic games has accompanied the increased ease of communication and transportation throughout the nation and throughout the world. This has inevitably led to the attainment of exact standardization in all the more important games. The hurdler in California compares his best efforts with those of the hurdler in Maine, under conditions as nearly identical as are physically possible; the tennis player from Seattle and the tennis player from Miami meet in Chicago and play the identical game that each has played at home. Therefore the facilities for the various games should be the same in all parts of the country.

**Size of Field.** Facilities for athletic games can be clearly divided into two classes, outdoor and indoor, and the most common outdoor facilities and those most intensively used are the athletic fields. The games provided for vary widely. The choice depends upon the popularity of the games, geographical location, climate, custom, tradition and policy, but also, and perhaps most important of all, upon the availability of land favorable for fields. The availability of favorable land influences not only the number of facilities provided but also to some extent the kind of facilities. Each acre of ground devoted to the game of polo can accommodate only about seven-tenths of one player at a time; but each acre of ground devoted to the game of lawn tennis can accommodate about 29 players simultaneously. Whereas ground area can be conserved for many activities by the common expedient of building upward in a vertical direction, floor over floor, for athletic fields this is not possible. The single ground surface must suffice, and conservation is possible only by economy of design, by rotation of games in different seasons, and by rotation of teams or players at different hours. Among the more important games provided for are: for boys and young men, football, baseball, track and field, tennis, soccer, lacrosse, golf, and less frequently cricket, polo and

handball; for girls and young women, basketball, field hockey, tennis, track and field. These are of course supplemented often by athletic activities such as rowing and ice hockey, but the latter are carried on outside the athletic fields, except that hockey is sometimes provided for on portions of athletic fields which are flooded in winter.

The size of any given athletic field and its player capacity for various games should rightly bear a logical relation to the number of expected players; but this is not generally the case because of the scarcity of land or the scarcity of funds for its development. Progressive increases of facilities are, however, in many cases reducing the deficiencies. Some fields, located in university towns, have from 50 to 100 acres and more of ground completely developed for a variety of games; but on the other hand many fields which are located at congested centers of population have only the most meager facilities. It is difficult to determine any consistent general averages, but it can perhaps be said that athletic fields for communities or institutions of moderate size are reasonably adequate if they have 10 to 20 acres of athletic fields per 1,000 potential users. For large communities or large institutions the acreage per 1,000 is and should be less.

**Technical Problems.** A great deal of study has been given to the technical problems involved in the construction of athletic fields, and efficient and economical means of solving these problems under widely differing conditions have been determined. The most important of these problems include: the determination of the ideal orientation of the field for each game so as to reduce to a minimum the interference of the rays of the sun; the production of the best surface for play, turf for fields, turf, clay or hard surfaces for tennis courts, cinders for running tracks; the installation of suitable and efficient drainage systems, etc.

Important features of the usual athletic field are the provisions for spectators and the dressing and bathing facilities for the players. At most athletic fields some facilities for spectators are provided, and these may be anything from simple benches, or portable bleachers, to imposing and monumental permanent grandstands or stadia with their numerous auxiliaries. The players' dressing and bathing facilities are sometimes located in a field-house, or locker building, and sometimes in team rooms under the seating deck of the grandstand or stadium. *See also* ATHLETIC BUILDINGS.

G. H.

**ATHLETICS**, a term covering all sports and pastimes requiring muscular exertion, but in a limited sense referring only to track and field events. Every nation has practiced some form of athletics, encouraged by those in authority to develop young men for warfare and to build up the physique of the nation as a whole. Probably no nation has ever enjoyed athletic sports as wholeheartedly as the ancient Greeks. Athletic development became almost a national religion, especially among the Spartans and to a lesser extent the Athenians. Winners at the Olympic Games ranked with conquering generals and city rulers, and

the names of famous athletes have come down to us with the names of great poets, dramatists, sculptors and statesmen.

The revival of the OLYMPIC GAMES has done much to arouse a spirit of wholesome competition among the leading civilized nations, and international contests in golf, tennis, polo, riding, swimming and other sports have fostered this spirit. Athletic sports offer a stimulating and healthful outlet for excess energy for people of every age. Organized games, junior editions of many adult sports, are available to children in almost every other country. Sports attracting young men are too many to list, but include track and field events, football, baseball, ice and field hockey, swimming, rowing, skating, lacrosse, tennis, golf, hiking, mountain climbing, squash, sailing, wrestling, boxing, calisthenics, polo, cycling and a score of others. (See separate articles under these heads.) Women participate in these sports in almost all countries, especially the United States, England, Germany and Finland.

**Women in Athletics.** Though classic mythology often pictures women as huntresses and runners, there is little trace of their real athletic activity until the middle of the 19th century. Before that, domestic duties and convention withheld them from most sports. One of the first women to preach better health through physical activity was Catherine Beecher, who in 1837 introduced calisthenic gymnastics for women. But not until 1889 were such gymnastics taken up, the Boston Normal School leading the way.

Croquet was one of the first outdoor sports which women enjoyed. Invented in 1830, it became by 1866 the courting game for young men and women. The first women's tennis tournament was held in 1881, the first women's golf tournament in 1895. Cycling became popular in the early '90s. Basketball was first played by women at Smith College in 1892. Field hockey has been popular in women's schools and colleges since the early 20th century, though the United States Field Hockey Association was not founded until 1921. The first national championship of women fencers was held in 1912. To-day women compete in swimming, fencing, track and field athletics and other sports, having made many excellent records. The programs of the OLYMPIC GAMES have included a large number of events for women since 1922.

**ATHLONE**, a district of County Westmeath, Irish Free State, lying on both banks of the Shannon, 78 mi. west of Dublin. The Athlone castle built in the reign of King John was in succeeding centuries considered an important strategic point and frequently besieged. Fortified until as late as 1797, portions of the early town walls and the castle survive. There also are ruins of a Franciscan foundation, of the ancient Abbey of St. Peter, of numerous ecclesiastical and other buildings in the southern environs, and to the northward about Lough Ree. To-day Athlone thrives upon its water-routed trade with Limerick and Dublin and upon the abundant salmon fisheries of the region. Nearby, the Shannon supplies electricity to all Ireland. Pop. 1926, 7,540.



**ATHOL**, a town in Worcester Co., Mass., on Miller's River, 45 mi. northwest of Worcester. It is served by the Boston and Albany and Boston and Maine railroads, and bus and truck lines; there is an airport. Hay, fruit and farm crops are raised locally. Chief manufactures are tools, leather, toys, celluloid goods, furniture and machinery. The retail trade in 1929 amounted to \$5,494,596. Beautifully located on the Mohawk Trail, the town has modern buildings, parks and historic sites of Indian, colonial, and pre-Civil war eras. Founded in 1735 and incorporated in 1762, Athol was named by Col. James Murray, a large landowner, after his ancestral estate, home of the dukes of Atholl. Pop. 1920, 9,792; 1930, 10,677, of which 35% were foreign-born.

**ATKANS**, one of two divisions of the ALEUT. They occupy Adreanof, Rat and Near islands in the Aleutian archipelago. They have been for many years Christianized and educated by the Russians, for whom they hunted sea-otters during the Russian tenure of the islands. Their native culture has been almost entirely superseded by that of Europeans.

**ATKINSON, THOMAS WILSON** (1867- ), American educator, was born in Spalding Co., Ga., Nov. 28, 1867. He graduated from Louisiana State University in 1891 and subsequently studied at Johns Hopkins and Cornell. In 1891 he went to the Louisiana State University as an instructor, becoming assistant professor in 1895 and professor in 1897. He was dean of the college of engineering at Louisiana from 1907-27; director of the Engineering Experiment Station from 1923-27, and acting president from 1927-29, when he became president.

**ATLANTA** or **ATALANTA**, in mythology, a huntress, the daughter of Schoeneus of Boeotia. She promised to marry the man who could outrun her, provided the losers were killed. **APHRODITE** gave **HIPOMENES** three apples of the Hesperides which he dropped in the path. Atlanta, stopping to pick them up, lost the race. Another Atlanta, daughter of Iasus of Arcadia, was the companion of **ARTEMIS** and took part in the Calydonian hunt with Meleager and in other feats.

**ATLANTA**, a city of northern central Georgia, the state capital and the county seat of Fulton Co. It is situated near the Chattahoochee River, at an altitude of over 1,000 ft. in the foothills of the Blue Ridge Mountains. The city has a healthy, equable climate. It is an important railroad center, with eight trunk lines and several branches serving it. Other transportation facilities include numerous bus lines and a municipal airport. Commercially, Atlanta is one of the outstanding cities of the south. Its excellent transportation facilities have made it the wholesale and distributing center for the rich surrounding agricultural region. More than 1,500 out-of-town firms make Atlanta their southeastern headquarters, and it is the fourth largest insurance center in the United States. In 1929 its diversified manufacturing industries produced a total output valued at approximately \$136,000,000, with cotton textiles, furniture, cotton-seed oil,

feed, fertilizers and soft drinks the principal products. Printing and publishing are also important. The city's retail stores, 3,910 in number, which did a total business of \$165,106,972, gave full-time employment to 27,495 men and women; the wholesale trade proper amounted to \$135,321,988. The sixth Federal Reserve Bank is here. Atlanta is the seat of the Georgia Institute of Technology, Oglethorpe University and Emory University; Agnes Scott College for women is nearby at Decatur. Stone Mountain, 15 mi. east of the city, a massive dome of granite, bears a huge memorial to the Confederacy, chiseled into the sheer face of the mountain. Atlanta was incorporated as a city in 1847. During the Civil War it was a munitions and supply center. In 1864 it was captured by Sherman, who burned the town when he started his march to the sea. There are many points of historic interest in and near the city. Pop. 1920, 200,616; 1930, 270,366.

**ATLANTA, SIEGE OF**, July 20-Sept. 2, 1864, an attack in the CIVIL WAR, by a Union army of about 100,000 men under Gen. Sherman. On July 17 the Union army, advancing from the north, crossed the Chattahoochee and established lines within eight miles of Atlanta. Gen. Johnston brought his Confederate troops, 40,000 men, within the defenses of the city, and strengthened fortifications. Suddenly, that same day, Jefferson Davis, president of the Confederacy, ordered Johnston to relinquish command to Gen. Hood. Hood, more impetuous and less skillful, attacked the enemy at Peach Tree Creek, on the outskirts of the city, July 20, and was beaten off. On the 22nd he attempted a second onslaught, with losses to the Confederate army of 8,000 men. The Union losses in these engagements were comparatively small. On July 28, when Sherman attempted to seize the railroads entering Atlanta from the southwest, Hood made a third assault, at Ezra Church, losing 4,000 men. Sherman drew his lines closer about the city, and in August controlled the avenues of supply into Atlanta. On Sept. 1, after destroying all ammunition and supplies that could not be removed, the Confederate army abandoned Atlanta. Sherman entered the city next day. The Union losses during the siege was 3,641 men; the Confederate, about 14,000.

**ATLANTA UNIVERSITY**, at Atlanta, Ga., a coeducational, non-sectarian institution founded by the American Missionary Association for the higher education of Negroes, was incorporated in 1867. At first it combined high school, college and normal courses; but in 1929 **MOREHOUSE COLLEGE** and **Spelman College** became affiliated with the university and Atlanta limited its field to graduate and professional courses. The university in 1931 had productive funds of \$326,244. The library contains 18,500 volumes. In 1931-32 there were 164 students and a faculty of 33, headed by Pres. John Hope.

**ATLANTIC**, a city in southwestern Iowa, the county seat of Cass Co., situated about 75 mi. west of Des Moines. The Rock Island Railroad serves the city. Near by is an intermediate airport for the



Omaha-Chicago Airway. The city is the trade center for a region producing fine farm crops. It has packing houses, poultry feeding yards and corn canning factories. Atlantic was chartered in 1869. Pop. 1920, 5,329; 1930, 5,585.

**ATLANTIC CITY**, a seashore resort city of Atlantic Co., N.J., situated on a narrow sand island separated from the mainland by an estuary and about 5 mi. of tidal flats, 110 mi. southwest of New York City and 55 mi. southeast of Philadelphia. Its transportation facilities include the Pennsylvania and the Reading railroads, electric trolleys, motor bus lines and, during the summer season, steamer and air lines. Notable for its wide, sandy beach, boardwalk extending for 8 mi., recreation piers and good hotels, it is one of the most popular Atlantic seaboard resorts. Its thousands of hotels, boarding houses and cottages accommodate several hundred thousand visitors during the season. In 1929 the local manufactures reached approximately \$8,000,000; the retail trade amounted to \$70,674,810. Atlantic City was settled about 1790 as a fishing village. First used for summer residences about 1845, it grew rapidly and was incorporated as a city in 1854. Pop. 1920, 50,707; 1930, 66,198.

**ATLANTIC OCEAN**, a large body of water bordered by Europe and Africa on the east, and the Americas on the west. It occupies a long, winding, comparatively narrow trough and has a surface area of approximately 31,800,000 sq. mi. The Equator divides it into North and South Atlantic. Its extreme north and south water boundaries are: between Labrador and Greenland, 59° 47' N. lat., separating it from the Arctic Ocean; between Greenland and Europe, 70° N. lat., from the east coast of Greenland to 15° W. long., separating it from the Greenland Sea; and a line from this point to the west and south coast of Iceland and thence east through the Faroe, Shetland and Orkney islands, separating it from the North Sea; at the south, a line joining Cape Horn and Cape Agulhas, separating it from the Antarctic Ocean.

On either side there are bodies of water connected with the ocean but not included in its area. These are the Bay of Biscay, Gulf of Guinea and Mediterranean Sea on the east, and the Gulf of St. Lawrence, Gulf of Mexico and Caribbean Sea on the west. Compared to the Pacific, the Atlantic has few islands, the principal ones being Bermuda, the Azores, Madeira, the Canaries and the Cape Verde and West Indian islands.

Bridging the transition from land to ocean depths there is a gradual slope known as the continental shelf. This varies in width and is particularly broad along Newfoundland, where it is known as the Grand Bank. From its edge the sea bottom slopes rapidly to considerable depths, where its surface is generally plain. The greatest variation is a low, irregular elevation or series of submarine plateaus called the mid-Atlantic ridge, which extends the whole length of the ocean, usually several thousand feet under water. On both sides of it are depressions which, when

they reach 18,000 ft., are called deeps. The Nares Deep not far from Porto Rico reaches 27,972 ft., the deepest known point in the Atlantic. Its average depth is 12,880 ft.

Midway between the Bahamas and the Azores is the Sargasso Sea, a circular area of relatively motionless water surrounded by great currents and characterized by floating seaweed. Its waters are remarkably clear and have exceptionally high temperature and salinity. The mean salinity of the ocean is 36.01.

The chief currents of the Atlantic are the north and south Equatorial, and the Gulf Stream, sometimes called a "river in the ocean," which begins where the Gulf of Mexico narrows to form a channel between the Florida Keys and Cuba, and flows with considerable velocity northeastward. The principal tributaries are the St. Lawrence, Mississippi, Amazon and Plata from the Americas; and the Niger and Congo from Africa.

**ATLANTIS**, in classical mythology, an island said to have lain in the Atlantic Ocean west of the Pillars of Hercules or the Strait of Gibraltar. The island disappeared and its identity has been variously stated as the Canaries, Scandinavia and America.

**ATLAS**, a Greek divinity of uncertain ancestry. Sometimes he is described as the leader of the TITANS in their contest with ZEUS, who condemned him to uphold the heavens on his shoulders and hands. He was supposed to know the depth of the sea and has become the symbol of geography.

**ATLAS MOUNTAINS**, a system of ranges in North Africa. The Atlas is not properly a mountain

chain, but consists of many distinct ranges running generally northeastward from Cape Nun in Morocco, opposite the Canary Islands, to Cape Bon, a distance of about 1,400 mi. It is roughly divided into two main chains. The first is known as the Maritime Atlas, which includes the ranges overlooking the Mediterranean from Ceuta to Cape Bon, and numerous subsidiary ranges frequently terminating at the coasts. The second consists of the inner and higher ranges which run about parallel with the Maritime Atlas, being divided from it by high plateaus. The inner ranges attain their greatest elevation in Morocco, and can be divided into three important sections: 1. the Great Atlas, which is the backbone of the system; 2. the Middle Atlas; and 3. the Anti-Atlas, or Jebel Sagheru, which stands nearest to the Sahara. These southern or inner ranges extend into Algeria where they are known collectively as the



ATLAS BEARING THE HEAVENS  
UPON HIS SHOULDERS  
*Statue in the Farnese Gallery*

Saharan Atlas, and though forming in reality one chain, are called by different names, such as Jebel Ksur, Jebel Amur, the Zab Mountains and Jebel Aures.

The Maritime Atlas, which is much more broken than the inner ranges, includes the mountainous region of the Rif in the Spanish portion of Morocco, and terminates at the Strait of Gibraltar, where it forms the promontory between Ceuta and Tangier. Eastward the mountains extend throughout the northern portions of Algeria and Tunis, where they are divided into five principal groups, including the Jurjura and Mejerda ranges. The former occupies the region known as the Grand Kabylie. The latter lies to the east of Constantine and to the south of the fertile districts known as the Tell. Between the Maritime Atlas and the inner ranges lie the great elevated plateaus of Algeria.

The Great Atlas in Morocco is seldom under 10,000 ft. in height; its principal peak, the Tinzar, is estimated to be 15,000 ft. There are mountain passes as high as the frequented passes of the Swiss Alps. The highest peak in Algeria is the Jebel Shellia, 7,611 ft., in the Zab range, and the highest peak in the Maritime Atlas is Lalla Kedija, 7,542 ft., in the Jurjura.

The Atlas ranges are pierced by many gorges. On the northern slopes there is abundant rainfall, and the vegetation is mainly European in character. Africa proper extends to the south of the mountains.

Climatically the region is one of extremes, for in the higher Atlas Alpine conditions prevail, with pastures and forests of oak, cypress and chestnut lower down. The plains nearer the sea are generally arid.

**ATMOLYSIS**, a term invented by Thomas Graham to denote that process of separating mixed gases which takes advantage of the different rates of **DIFFUSION** through a porous septum or diaphragm.

**ATMOSPHERE**, the gaseous envelope surrounding the body of the earth, and extending for several hundred miles upward. It is a mixture of gases called air, but not a chemical combination of them. The average composition of sea level is as follows: nitrogen 77%, oxygen 21%, argon, one of the rare gases, 0.93%, carbon dioxide 0.03%, water vapor 1.2% with very small admixtures of other gases, such as neon, helium, krypton and xenon. The actual amount of water vapor varies greatly with the locality on earth, and with the seasons, and may reach as much as 2.6% in the tropics.

Up to a height of 5-10 miles above sea level the relative proportions of these constituents remain nearly constant, except for water vapor which is restricted to the surface, but at great altitudes the lighter gases such as helium increase. It is possible even that at very great altitudes, hydrogen, practically absent at sea level, begins to predominate. The upper atmosphere contains a small quantity of **OZONE**, a short-lived variety of oxygen composed of three atoms instead of the usual two. It is formed by the action of the ultraviolet rays in the sun's light. The oxygen

of the atmosphere is constantly being withdrawn, and converted into carbon dioxide by the respiratory processes of animals and plants, at night, while the reverse takes place in green plants under the influence of sunlight and is called **PHOTOSYNTHESIS**. Occasionally the atmosphere may contain minute quantities of nitrous oxides formed by lightning or sulphur compounds from volcanic fumes while in the neighborhood of cities and industrial areas combustion products of fuel as well as dust and solid impurities of various kinds may be present.

The weight of the entire layer of gases results in their exerting a pressure called the barometric pressure, and equal, on the average to 14.7 lbs. per square inch at sea level. This corresponds to the weight or pressure of a column of mercury 29.96 inches high, and it is customary to express the atmospheric pressure in inches of mercury. This barometric pressure is subject to large fluctuations both seasonal and irregular confined between the extremes of 27 and 31 inches at sea level; high pressure is generally associated with fair weather, low pressure with storms. The position and motion of such areas of high and low barometric pressure are therefore of importance in weather forecasting. At sea level the density of the air is about 770 times less than that of water, but this as well as the pressure diminishes rapidly with increasing altitude, at first about one inch per 1,000 feet, later on more slowly, until at a height of 20 miles the pressure is no more than one-third of an inch.

It is estimated that the total mass of the atmosphere is 5,000 million million tons, a little less than one-millionth of the whole mass of the earth. Half of this lies below 3.6 miles above the surface of the earth. The ozone in the upper part of the atmosphere absorbs that part of the ultraviolet of the sun's rays that is injurious to life, but allows most of the visible sunlight to pass through. On the other hand it absorbs also, and to a higher degree, the heat radiation from the earth, and thus virtually acts as a blanket, protecting the surface of the earth against the cold of empty space. This protective property of the atmosphere is dependent upon its degree of **HUMIDITY**; the greater the moisture the better the blanket.

Actual temperatures of the atmosphere near the surface of the earth are dependent, principally, upon latitude but subject to large diurnal, seasonal and erratic variations beyond being influenced and moderated by ocean-and-air currents tending to equalize the distribution of heat, as well as by local conditions such as rainfall, altitude and vegetation. The greatest extremes occur in regions of great drought, not at the poles and the equator. A temperature of 136° has been recorded in the northern Sahara, while the record for extreme cold is held by Verchoyansk, in northern Siberia, with 92° F. below zero. The average annual temperature at the poles is about 0° F., that at the equator about 80° F.; the average temperature of the earth may be taken as 45-50° F. Although the northern hemisphere receives the great-

est amount of heat on the day of the summer solstice, the temperature continues to rise until that date upon which as much heat is received from the sun as is radiated from the earth, which generally occurs about August 1. Similarly the lowest temperature in winter is reached around February 1 on the average, while in the southern hemisphere the conditions are reversed.

The lowest layer of the atmosphere, called the troposphere, contains practically all the water vapor and marks the region of turbulence and convection currents; in it are formed the clouds. Though its average thickness is 6 miles, the troposphere is thicker at the equator (10 miles) and thinner at the poles (3-4 miles), and varies from summer to winter. The temperature in the troposphere decreases with its height, at the nearly uniform rate of about  $16^{\circ}$  F. per mile. The boundary between the troposphere and the next layer, the stratosphere, marks the region of lowest temperature. Since this boundary lies highest in the tropics the upper air is colder there, probably in the neighborhood of  $100^{\circ}$  to  $130^{\circ}$  F. below zero, while in the temperate zone it reaches to about  $67^{\circ}$  F. below zero. The stratosphere is dry and through its extent, up to about 40-45 miles high, nearly constant in temperature, being around  $70^{\circ}$  below zero F. In the tropics the temperature actually increases upward from the coldest region at the lower boundary to this value.

What the conditions are beyond this is difficult to say, since meteorological sounding balloons with self-recording instruments have not reached altitudes greater than 25 miles. It is surmised, however, that the next layer, in which meteors are most frequent, may actually increase in temperature, owing to the presence of ozone. Some investigators even estimate its temperature as high as  $50^{\circ}$  F. At about 50 miles above the surface there seems to be a sharply defined boundary between two layers, called the Kennelly-Heaviside layer, which plays an important part in radio since it reflects electric waves downward.

Observations of meteors show that there is still an appreciable density of air at a height of 100 miles, while streamers of the aurora borealis have been observed as high as 500 miles. At 2,000 miles it has been estimated that there are no more than a few million gas molecules per cubic inch, and the pressure must be less than a millionth of a millionth of that at sea level, while the temperature in these regions gradually descends to that of space— $450^{\circ}$  below zero F. Altogether the atmosphere reflects, absorbs and scatters about 40% of the solar radiation, only 60% finally reaching the surface of the earth. The scattering, which takes place by the action of very fine dust particles, is selective, blue light being scattered more than red and thus making the background of the sky appear blue to us. *See also* ATMOSPHERIC ELECTRICITY, CLIMATE, RAINFALL, etc. W.J.L.

**ATMOSPHERIC ELECTRICITY.** The earth and its ATMOSPHERE form a complex electrical system subject to influences from the sun and, probably, from

the rest of the cosmos. Much information on the electrical state of the atmosphere has been gathered in the temperate regions of the North, not so much in the tropical regions and the temperate regions of the South, some on the oceans and some in the Antarctic. Even so, the portion subject to direct observation is very limited. Laboratory observations can be made near the surface of the earth, and instruments can be sent up several miles in balloons, but, at higher levels, inferences must be drawn from the study of radio transmission, TERRESTRIAL MAGNETISM and the AURORA BOREALIS.

The surface of the earth, apart from local and transient disturbances, carries a negative electric charge. The air carries a prevailing positive charge. Since like electric charges repel one another and unlike charges attract, any free positive charge in the air will be subject to a force acting toward the earth. Thus, there is an electric tension or potential difference between a point in the air and a point on the earth beneath it. In fair weather, the average of this potential difference at a yard above the surface of the earth is about 100 volts (*see* UNITS, ELECTRICAL). With increasing elevations, the potential difference increases, but at a progressively smaller rate. At about six miles, the increase is quite slight, and probably the potential of the entire upper atmosphere, except for transient disturbances, does not exceed 1,000,000 volts. This decrease in the potential gradient results from the fact that at the higher point of observation, more positive charge intervenes between the point and the earth to neutralize the force due to the charge on the earth.

The average intensity of the electric field near the earth's surface shows an annual and a daily variation. In Europe and, probably, in the temperate zones of both hemispheres, the intensity is greatest in winter and least in summer. In the Antarctic, the annual variation is in phase with that of the North Temperate Zone. In most places, the potential difference is lowest in the early morning and greatest, about twice as great as in the morning, in the late afternoon; the variation recurs every 12 hours. It is less marked in winter than in summer, and is not observed either at high latitudes or at high elevations. There is also evidence of a daily variation occurring with the same phase at different longitudes.

In thunderstorms, the electric intensity undergoes violent reversals, fluctuating in a few minutes between positive and negative values 100 times greater than the normal values. It is estimated that potential differences of 1,000,000,000 volts may develop within a thunder cloud. These tensions are relieved by the violent discharge of electricity in LIGHTNING, by the gentler discharge known as St. ELMO'S FIRE and by invisible discharges.

Invisible electric discharges between the atmosphere and the earth are continuous, in fair as well as in stormy weather. The earth's negative charge attracts positively charged particles in the air and repels those charged negatively. There is a continuous process of dissociation and recombination of molecules, every dis-

sociation giving rise to a particle, or ION, charged positively and to an ion charged negatively. Near the earth, over the surface of the land, the principal dissociating agencies are involved in the radiations from radioactive materials (*see* RADIOACTIVITY) in the earth and air, and the minor agent is the penetrating, or cosmic, radiation (*see* COSMIC RAYS). Over the sea, the effect of the penetrating radiation predominates. In the upper air, the dissociation is far greater than near the earth. It is ascribed chiefly to the ULTRA-VIOLET RADIATION of the sun, which is largely absorbed before it reaches the lower atmosphere. This dissociation makes the upper air so highly conductive that it functions like an electric shield, by which, in part, radio waves (*see* HERTZIAN WAVES) are guided over the curved surface of the earth. To the greater conductivity of the upper air is ascribed some of the accumulation of the positive charge of the atmosphere in the lower, less conducting layers.

Near the surface of the earth are found ions much larger than those which are parts of dissociated molecules. These are probably dust particles to which the smaller ions have become attached. They are too massive and, hence, too immobile, to add much to the conductivity of the air, and they may even reduce it by binding together the more mobile small ions. Thus, although the radioactive substances in the earth produce more ions over the land than over the sea, there is little difference in the conductivity of the air.

The current from air to earth caused by the migration of ions is not great. In fair weather, over an area the size of California, the total current would be only about equal to that which passes through a 100-watt lamp. Hence, atmospheric electricity can not be utilized for commercial power. However, this current would neutralize the most of the earth's charge in a few minutes if it were not for some compensating action which maintains the potential difference between the earth and the air. Many theories are suggested as explanations. The potential difference may reverse in thunderstorms, or even in fair weather, causing a reversal of the current. Positively charged gases may diffuse from the earth. Negatively charged particles, ELECTRONS, may penetrate to the earth from the sun, the slower positively charged particles accompanying them being absorbed by the air. Cosmic rays may expel electrons from the molecules of the air with sufficient velocity to penetrate to the earth.

R. T. C.

**ATMOSPHERIC REFRACTION.** *See* REFRACTION.

**ATMOSPHERICS**, disturbances in radio circuits caused by electrical discharges in the atmosphere (*see* ATMOSPHERIC ELECTRICITY). They occur more frequently in summer than in winter and more frequently in tropical than in temperate regions. They always accompany thunderstorms and frequently precede the actual storm.

As used by radio engineers, *static* is synonymous with *atmospherics*, but, in popular language, any extraneous noise in a receiving set is likely to be ascribed

to static. Only 15% of such disturbances in the northern United States are of atmospheric origin. The remaining 85%, being man-made, may be partially controlled or eliminated. No method of eliminating or of effectively reducing the disturbances due to atmospherics is known, nor does it even seem possible.

**ATOLL**, the Malay term for a low, ring-shaped coral island formed upon a belt of reef encircling a central lagoon. Such islands are common in the South Seas and the Indian Ocean. Some of them measure forty to sixty miles in diameter and enclose lagoons 100 to 350 ft. deep, which teem with fish. The larger atolls have acquired a thin soil, which supports luxuriant vegetation, and many, as in the Low Archipelago, are inhabited.

Darwin's theory that atolls represent former barrier-reefs which have grown steadily upward during the slow subsidence of their central islands, is borne out by modern research.

**ATOM**, an elementary particle of matter, combinations of which make elements, combinations of the 92 elements, in turn, making up every substance in the universe. The atoms of any one element are the same, as far as is known to-day. Since the diameter of an atom is roughly one one-hundred-millionth centimeter, and since the mass, say for HELIUM, is only seven-million-billion-billionths grams, it is obvious that a large number of atoms are required to make up an object of ordinary size and weight. Twenty-seven billion billion atoms of helium, under standard conditions of pressure and temperature, are required to fill one cubic centimeter of space.

Each atom is extremely complex in itself, consisting of a heavy, central, positively charged core, or NUCLEUS, surrounded by light, negatively charged particles called ELECTRONS. The neutral atom has an equal amount of positive and negative electricity, whereas a charged atom has lost or gained electrons in the outermost "shell." The energy required to remove the most loosely bound electron is the minimum ionizing potential. This ranges up to 25 volts, being different for different elements.

The electrons which surround the nucleus occupy definite energy levels under normal conditions, there being two electrons in the innermost shell, eight in the next and an increasing number in successive shells. HYDROGEN, the lightest element, has one electron; helium, the next lightest, has two, the number of electrons increasing by one progressively from the lighter to the heavier elements. The radiation of light occurs when one of the electrons from an outer shell, displaced by some external agency, falls back to one of the outer energy levels. Characteristic X-RAYS are produced when one of the inner electrons undergoes a transition between two energy levels close to the nucleus. The energy required for a single transition is always one quantum. The atom possesses a tremendously large amount of energy, and for that reason it is very difficult to decompose it, a feat which was first accomplished by Millikan in 1931 by means of COSMIC RAYS and by Drs. Cockroft and Walton in

1932 by electrical methods. *See also* QUANTUM THEORY. J. B. H.

**ATOMIC NUMBER**, a whole number expressing for each chemical element its place in a consecutive arrangement of the elements. It is identified with the net positive charge on the central core or nucleus of the atom, the net positive charge being the excess of positive charge (protons) over negative charges (electrons), the phenomenon of radioactive disintegration showing that both are present in the nucleus. For a neutral atom this requires that the number of electrons outside the nucleus shall also be equal to the atomic number.

The atomic numbers range from 1 for hydrogen, the lightest element, to 92 for uranium, the heaviest. Helium, atomic number 2, contains four protons and two electrons in the nucleus (net positive charge equals two), with two electrons outside the nucleus. *See also* ELEMENTS, CHEMICAL; NUCLEUS; PROTON; ELECTRON; ISOTOPES; RADIOACTIVITY; PERIODIC SYSTEM OF CHEMICAL ELEMENTS.

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**ATOMIC THEORY**, the theory that all matter is composed of exceedingly small units called *atoms*. The characteristics ascribed to the atoms are the following: (1) All the atoms of the same element are alike in properties. (2) The atoms of different elements are unlike. (3) Compound substances result from the union of atoms of different elements. The atom is thus the smallest quantity of an element possessing the properties of the element as a whole. While it is true that this ultimate chemical unit is so small that the utmost subdivision artificially attainable cannot succeed in its isolation, the important point remains that the atomic theory does establish for the subdivision process a theoretical limit, to exceed which implies destruction of chemical individuality. Among the important successes of the atomic theory may be mentioned the following: It explains the identity in the properties of different samples of the same element, since different samples thus consist simply in different numbers of identical atoms. It accounts for the Law of Conservation of Matter, since through any series of chemical changes there must remain exactly the same number of atoms of each element as at the beginning, although the individuals may have changed partners in the process. Finally, it agrees with the known facts of chemical combination in definite proportions, since if the atoms are indivisible, one atom of an element A must unite, if at all, with one, two, three or more atoms of other elements, but not with fractions of atoms.

*See also* CHEMISTRY: History; COMPOUND; CONSERVATION OF MATTER; ELEMENTS, CHEMICAL; KINETIC THEORY. L. O. C.

**BIBLIOGRAPHY**.—Alexander Findlay, *The Spirit of Chemistry*.

**ATOMIC VOLUME**, the volume occupied by one atomic weight (in grams) of an element. The atomic volume is not measured directly, but is calculated by

division of the atomic weight (grams) by the density (grams per cubic centimeter) of the element (since  $\text{mass} = \text{volume} \times \text{density}$ ). The atomic volumes of the elements, like many other properties, are found to be periodic functions of the atomic weights; i.e., they vary in a regular and recurring manner through the series of elements from the element of lowest to that of highest atomic weight, with similar elements occupying corresponding portions of the curve.

**ATOMIC WEIGHT**, the smallest weight of an element found in any of its known chemical compounds, referred to an arbitrarily selected value of 16 for the element oxygen. As the gram is the characteristic *physical* unit of mass, so is the atomic weight the characteristic *chemical* unit. Since all determinations of the percentage composition of chemical substances require a knowledge of atomic weights, their numerical values are of the greatest importance. For this reason, determination of an atomic weight involves the most painstakingly accurate processes of chemical analysis which it is possible to attain.

On the basis of oxygen = 16, the atomic weight of hydrogen, the lightest element, is 1.008. It might, therefore, appear more reasonable to adopt as the standard of reference hydrogen = 1. The chief reason for the universal acceptance by chemists of the oxygen standard is that a great many more elements form stable compounds with oxygen than with hydrogen. L. O. C.

**ATOMISM**, a philosophical position going back to Leucippus and his more illustrious disciple, DEMOCRITUS, the first great materialist (c. 420 B.C.). According to this point of view the universe is composed of a homogeneous material substance divided into an infinite number of parts. These parts differ only in size and shape, but are alike in their other properties. Motion is located within the atoms themselves and is not imposed from without as in the case of the *nous* of ANAXAGORAS.

Not all atomistic conceptions take the form of materialism, however. Thus the Leibnitzian monad is essentially a spiritual atom. Though it has separate and independent existence it mirrors the whole universe. The term atomism has been extended to include any type of thought which analyzes the things of experience into original elements. Thus, when individuals are regarded as elements of society and set up as having an independent existence, it is proper to refer to such thought as a form of social atomism.

**ATOMIZATION, ELECTRICAL**, a process for the production of certain colloidal solutions (*see* COLLOIDS) called electrosols, wherein an electric arc is passed between pure metal electrodes in distilled water. The resultant electrosol consists of fine particles of the metal, e.g., gold, dispersed in water. It is stable because the electrical charges on the surface of the particles are mutually repellent and prevent the collision and consequent precipitation of the particles. The method was probably first used by FARADAY and has been greatly improved by Bredig and Svedberg.

*See* J. Alexander, *Colloidal Chemistry*, Vol. I., 1926.

**ATONALITY**, in music, the absence of a fixed tonal focus or key-note. Prior to the rise of harmonic music in 1600 the importance of tonality was negligible; but thereafter for two and a half centuries, tonality acquired increasing significance and became one of the outstanding characteristics of the classical and romantic schools of music. As a reaction to this tendency, which definitely showed itself toward the close of the 19th century, the doctrine of atonality was developed. Although the importance of harmony was still recognized, for harmony, indeed, may be termed the major concern of post-romantic and modern composers, the accepted boundaries of previous eras were considered too formal and narrow to be fruitful. Accordingly, experimentation began with more rapid modulation, and from these experiments arose the belief that modulation, or the transition from one key to another, was actually needless, since no one key was to be thoroughly established in the auditor's mind; rather, all so-called keys were mere transition points instead of tonal centers. In brief, the sense of tonality was to be kept in a state of perpetual flux, and non-existent save for being highly fluid. The formal inception of this doctrine of atonality is commonly attributed to Arnold Schönberg (1874- ), and has since been developed by such ultra-modern composers as Edgar Varèse (1885- ), Arthur Honegger (1892- ), Ildebrando Pizzetti (1880- ), Arthur Bliss (1891- ), and Ivor Stravinsky (1882- ).

**ATONEMENT**, one of the few theological terms of English etymology. Analyzed into syllables, the word means any act by which two people, after alienation from one another, are made "at one." According to the orthodox faith of the Christian Church, God is love and an attribute of love is justice. As a sinner, man has offended against the love of a just God and is alienated from Him. By his Passion Christ, who never sinned, "became sin" for man, suffering though just for the unjust and so satisfying that element in the God-head which cannot tolerate evil. In the words of Jesus, he came "to give his life a ransom for many" or in Pauline phrase to be "propitiation." This conception of the Atonement is sometimes described as the substitutionary, and in the Epistle to the Hebrews there is evidence that the early Church explained it by an elaborate use of the symbolism inherent in the ceremonial of the Jewish temple, where the blood of bulls and goats was shed in atonement for sin. Many modern theologians prefer to apply the word, "vicarious," to the atonement. They recognize that the sin of the world was concentrated on the Crucified Savior and that this involved the Sufferer in an awful and mystical agony of soul, but they point out that despite this experience of man's inhumanity to man, Jesus was able still to love and forgive humankind. Thus did he reveal the unbounded forgiveness of the Father, and open a way by which man may approach the heart of the eternal. Between the substitutionary and the vicarious views of the Atonement the difference may

prove to consist chiefly in emphasis, and there are many variants in the interpretation of this mystery. The non-Christian view of the cross omits Atonement altogether; according to this point of view, Jesus was a good man who suffered an undeserved martyrdom which may be compared to the death of Socrates or any other victim of human prejudice.

**ATREIDES**, the royal family of Mycenæ, famous in Greek mythology. The founder of the house was Atreus, a son of PELOPS, and grandson of TANTALUS, who were descended from ZEUS, the Roman Jupiter. Urged on by their mother, Hippodameia, Atreus and Thyestes killed their step-brother, Chrysippus. After the murder the brothers fled, but the family was not peaceful for long because Thyestes led Aerope, wife of Atreus, away with him. At the same time he stole the lamb with the golden fleece which Hermes had given to the king (*see* JASON). The brothers later became reconciled but Atreus, still seeking to avenge the seduction of his wife, killed the sons of Thyestes. He then invited Thyestes to dinner at which their flesh was served as meat. Thyestes, learning the truth, pronounced a curse on the family and departed, thereby escaping the famine that came upon Mycenæ.

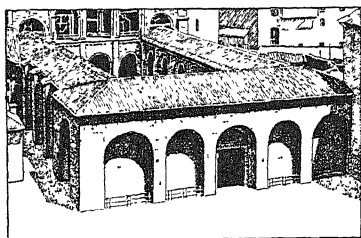
The next incident in a terrible story was a guilty love between Thyestes and Pelopia, whom he did not recognize as his daughter. Their son, Ægisthus, was reared by shepherds and fed by a goat, whence his name. Not aware of her identity Atreus married Pelopia whom he believed to be a daughter of Theseus. He sought for Ægisthus and brought him up as his own son. Unfortunately, Pelopia when visiting her father had taken away his sword and this evidence of her crime led Atreus to send Ægisthus to Mycenæ to kill Thyestes. Upon learning that he had murdered his own father, Ægisthus returned and slew Atreus.

Grandsons of Atreus were the brothers, AGAMEMNON and MENELAUS. The wife of Menelaus was HELEN and it was her elopement with PARIS which provoked the Greeks to besiege Troy. Agamemnon's wife was Clytemnestra, and during her husband's absence at the war, Ægisthus won her affections. On his return to Mycenæ, Agamemnon was invited by Ægisthus to a banquet and there murdered. Eight years afterward, ORESTES, son of Agamemnon, avenged this deed by assassinating Ægisthus. The daughters of Agamemnon and Clytemnestra were IPHIGENEIA and ELECTRA.

**ATRIPLEX**, a numerous genus of herbs and low shrubs of the goosefoot family many of which are known as ORACH or saltbush. There are about 180 species native to temperate and subtropical regions; some 60 occur in North America, chiefly in dry sandy soils in the western United States. They are mostly scurfy or silvery-hairy plants with alternate leaves and small green flowers in axillary or terminal clusters. The orach (*A. hortensis*), native to Asia, is much cultivated in Europe as a potherb. Various Australian species, commonly called SALTBUSH, are grown for forage. *See* DESERT HOLLY.



**ATRIUM**, originally the central hall of a primitive Italian house, with a hearth, and a hole in the center of the roof to let out the smoke. Later, with the growing complexity of the Roman house plan, other rooms were set apart for cooking, the slope of the roof was reversed, and a basin to catch the rain water replaced the original hearth; the atrium thus became a small court. In imperial houses it was often a large court, colonnaded. It always served as the official



ATRIUM OF THE CHURCH OF SANT'  
AMBROGIO, MILAN, ITALY

center of the house, where the householder carried on his business. Family life was removed from the atrium at an early period to other courts or peristyles further from the entrance. The typical Roman atrium had recesses or wings opening at the sides, known as *alae*, and in the center of the rear was the *tablinum*, an official reception room containing the family portraits. The hole in the roof was known as the *compluvium*, and the basin to catch the water as the *impluvium*. Beside this basin often stood a table, and a well head leading down into a rainwater cistern.

**ATROPHY**, a wasting of tissues or of part of the body. See **PATHOLOGY**.

**ATROPINE**, a powerful and poisonous alkaloid occurring in many of the plants of the family *Solanaceae*; it is the most important of the alkaloids in *Atropa Belladonna* or deadly nightshade. Atropine has been synthesized, as have a number of valuable derivatives, such as homatropine, the effect of which is quicker and less lasting.

The alkaloid itself is only slightly soluble in water. It is, therefore, most commonly used in the form of atropine sulphate  $(C_{17}H_{23}O_3N)_2H_2SO_4 \cdot H_2O$ . The pupil-dilating effect of atropine is most characteristic. Atropine paralyzes the parasympathetic nerve endings. The preparations are used chiefly as mydriatics, to suppress body secretions, as in gastric hyperacidity, and to quicken the heart, regulate peristalsis and lessen bronchial spasm.

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**ATROPOS**, in mythology, the eldest of the three **FATES**.

**ATSINA**, a Plains Indian tribe speaking a western dialect of the Algonkian stock. They are a branch of the **ARAPAHO** and are segregated at Fort Belknap Agency in Montana. They were in the past closely associated with the **BLACKFOOT** and are better known as **GROS VENTRE**, and thus often confused with the **HIDATSA**, who were called Gros Ventre of the Missouri.

**ATSUGEWI**, an American Indian tribe of the Shastan linguistic stock. Their former habitat was in Hat Creek, Burney and Dixie valleys in California. A small number of the Atsugewi now survive, mainly full bloods. Culturally they are classed as identical with the **ACHOMAWAI**.

**ATTACAPAN**, a tribe and North American Indian stock now extinct. The name has been applied generally to various tribes which lived in southwestern Louisiana and southeastern Texas, and the **KARANKAWA** and several other groups were included with them. There appear to have been two dialects in Attacapan, an eastern and a western dialect spoken by the remnants of the group known in the early 19th century and then living in Calcasieu Parish in Louisiana. From the brief accounts of the Attacapan it is known that they were agriculturists, the women carrying on the labor in the fields, that the men hunted buffalo with bow and arrows, and that their kinship system was teknonymous, at least in part, the father being called not by his own name, but as the father of his child.

**ATTACHMENT**, an apprehending or seizing of a person or of property under a writ in order to bring the person or property into the custody of the law. The term is used chiefly with reference to attachment of property either at the beginning or during the progress of an action in order that it may stand as security for satisfaction of the judgment to be recovered by the plaintiff. It is generally provided for by statute in case of non-resident, absconding, hiding, or fraudulent debtors.

**ATTACK PLANES**. See **AIR FORCE**.

**ATTAINDER**, the forfeiture of all property rights. It was formerly employed in **ENGLISH LAW** when the death or outlawry sentence was pronounced in case of treason or **FELONY**. The U.S. **CONSTITUTION** does not permit attainders.

**ATTENTION**, a phase of volition. Attention is also largely a matter of interest, for unless an object is forced upon our attention we ordinarily attend to those things in which we are most interested, or at least most concerned. Attention is that process by which an object or an idea is held before consciousness for a given length of time.

It was William James who made the distinction between marginal and focal attention. At any given moment there will be a number of things on the fringe of consciousness. This corresponds to marginal attention. As these objects become more useful or significant for the individual they may shift to the center of attention, or to its focal point. The point where attention is most highly focalized has been designated by James as the 'hot spot' of attention. It is apparent that objects and ideas are constantly shifting from focal to marginal consciousness and vice versa, or perhaps falling out of consciousness altogether. An idea may suddenly shoot up from the subliminal regions of consciousness and possess the hot spot of attention. At times such ideas are very obtrusive.

Attention may be either active or passive, depending on the amount of effort involved in the process. A loud noise, suddenly heard, forces itself upon the attention; here attention is passive. Little or no effort is required to attend to such a stimulus. In fact it might be very difficult not to attend to it if the stimulus persists. Attention is active when more effort is required. It may take considerable concentration to solve a difficult mathematical problem. Attention is active when sustained effort is required to meet a given situation. There is also a selective process involved in attention. Not all things are attended to equally. This selective process has both its negative and its positive aspects. On the negative side is the eliminating element and on the positive side is the accepting element. Attention will seize upon some ideas while others will be passed by without further consideration. Many otherwise interesting objects may be ignored because they are not the object of interest at the time. Attention does not notice them. The novelty, duration and intensity of the stimulus are all factors of attention.

**BIBLIOGRAPHY.**—W. James, *Principles of Psychology* (1890); W. B. Pillsbury, *Attention* (1908).

**ATTENUATION**, the reduction of intensity of a TELEPHONE or radio signal (*see* HERTZIAN WAVES) with distance traversed, or the diminution of electrical power through successive elements of a network (*see* POWER TRANSMISSION.)

**ATTERBOM, PER DANIEL AMADEUS**, (1790-1855), Swedish poet, was born at Asbo, Jan. 19, 1790. He was one of the leaders of the group known as the Phosphorists, and one of the founders of the magazine *Phosphorus* from which the group took its name. The tendency of this group was away from the French academic tradition and toward the German Romantic movement (*see* ROMANTICISM). Atterbom was tutor to Crown Prince Oscar and later professor of philosophy at Upsala University. Among his writings are *The Flowers*, a collection of poems; *The Blue Bird*, a fairy drama; and *The Isle of Bliss*, a romantic drama. He died at Upsala, July 21, 1855.

**ATTESTATION**, the witnessing of an instrument in writing at the request of the person executing it. The attesting witness subscribes his name either to a formal attestation clause or preceded by the word "Witness."

**ATTIC**, in architecture, (1) an upper story in a building wholly or partly in the roof; and (2) the portion of the wall of a classic building above the main cornice, or a decorative screen wall similarly placed. In classic architecture the attic usually consists of a projecting base, molded; a central, vertical portion; and a projecting molded cap. The attic is a favorite place for inscriptions, as on Roman triumphal arches, and for decorative carving and sculpture.

**ATTICA**, an ancient division of Greece, with Boeotia on the north, Megaris and the Saronic Gulf on the southwest and the Aegean Sea on the east. Athens was its capital. The land is mountainous with plains between the ridges. Mt. Cithaeron at

the west and Mt. Parnes on the east lie in the north of Attica. Mt. Hymettus, celebrated for its bluish-gray marble and its honey, is southeast of the Athenian plain; Mt. Pentelicon, famous for its white marble, is on the northeast of the same plain. In the extreme south is Laurium with its silver mines. The plain of Eleusis is in the western part of Attica with the island of Salamis south of it. The Cephissus and Ilissus are the chief rivers in the district. They, however, run dry in summer. The town of Piraeus is the harbor southwest of Athens. According to legend, the early clans were formed into a state by Theseus. Cleisthenes divided the country into demes or districts.

**ATTIC SALT**, pungent and delicate wit. Salt both in Greek and Latin was a common term for sparkling thought well-expressed. This phrase is especially applicable to the vigorous wit of the Athenian writers, as compared with the ponderous style of the Romans.

**ATTICUS HERODES, TIBERIUS CLAUDIUS** (c. 100-c. 180), Greek rhetorician, was born at Marathon, about 100. He taught at Athens and Rome, served as Consul under Antoninus Pius and at his death had acquired a fortune. Two of his pupils were future emperors, MARCUS AURELIUS and LUCIUS SEVERUS. Atticus Herodes is especially noted for the public buildings, including theaters and stadiums, which he gave to Athens, Corinth, Delphi and other Greek cities.

**ATTILA, or ETZEL**, surnamed the Scourge of God (406-c. 453), King of the Huns, was born in 406, the son of Munduk. Attila, coming with his brother to the throne in 433, ruled not only the Huns but numerous other tribes. His followers believed him destined to govern the whole world. In 444 he had his brother killed. His first wars, fought in the east, sought only plunder and tribute. However, the sister of Valentinian, the western Emperor, by offering to marry Attila, gave him what he chose to consider a claim on the empire, and his subsequent campaigns were efforts to substantiate it. In 451 his army entered Gaul, but was checked at Orleans and retreated to Chalons, where it was defeated. He appeared in Italy sometime after his defeat and threatened Rome, the Pope, Leo the Great, coming to treat with him. Attila eventually withdrew, and did not attack Rome as was expected. Shortly after his death in 453 his empire fell to pieces.

**ATTIWENDARONK**, an important federation of Iroquois tribes, living in the 17th century north of Lake Erie, in Ontario, Canada, with some villages in the Genesee valley, N.Y. Their territory extended west of the Detroit River and Lake St. Clair. The French named them Neutrals because they took no part in the wars between the Iroquois and the Huron. The Neutrals were conquered by the Iroquois in 1650 and the remnants of the federation were incorporated with the Seneca villages in New York.

**ATTLEBORO**, a city in Bristol Co., southeastern Massachusetts, situated 12 mi. northeast of Provi-

dence, R.I. It is served by the New Haven Railroad and interstate trolley and bus lines. Attleboro is a manufacturing center, producing goods valued approximately at \$32,000,000 in 1929. The retail trade in the same year amounted to \$9,487,670. The local jewelry industry was established in 1780; the city has also a large dyeing and bleaching plant and various other industries. Settled in 1669 by John Woodcock, Attleboro was incorporated as a town in 1694 and as a city in 1915. Points of interest include a powderhouse used during the Revolution, and the Angle Tree Monument, erected in 1790. Near by is an interesting glacial rock ledge. Pop. 1920, 19,731; 1930, 21,769.

**ATTORNEY-GENERAL.** At common law the chief law officer of the kingdom, appointed to represent the king in his courts of law. In the United States the Attorney-General is the head of the Department of Justice and a member of the President's Cabinet. He represents the United States in the courts in cases of sufficient importance to require his attention, and gives legal advice to the President and heads of departments, upon questions on which his opinion is asked. In each state there is an Attorney-General with the general powers and duties of the Attorney-General at common law. Usually in the state polity the office is an elective one.

**ATTRITION**, a medieval term in Roman theology. The true contrition of the sinner is held to be a detestation of sin arising out of sorrow because the love of God has been offended. If the penitent is moved by another and less exalted impulse, such as fear of hell or a sense of the heinousness of guilt, his contrition is held to be imperfect and is described as attrition.

**ATUAMI**, an American Indian tribe belonging to the Shastan linguistic stock, their former habitat having been in Big Valley, Lassen Co., Cal.

**ATWOOD, GEORGE** (1746-1807), English physicist, was born at London in 1746. In 1784 he invented Atwood's Machine, a device which demonstrated the relations of time, space and velocity in a falling body. His device made possible the study of gravitational attraction by permitting a body to fall with any desired acceleration. Atwood died at London, July 11, 1807.

**ATWOOD, WALLACE WALTER** (1872- ), American geographer and geologist, was born in Chicago, Ill., Oct. 1, 1872. In 1897 he graduated and in 1903 received the degree of Ph.D. from the University of Chicago, in which he thereafter served as assistant professor and associate professor of physiography and geology until 1913. He was professor of physiography at Harvard from 1913 to 1920, when he became president of Clark University. In 1901-09 he was assistant geologist with the U. S. Geological Survey. Among his writings, which include numerous contributions to scientific and educational periodicals, are *Physical Geography of the Devils Lake Region*, 1899; *Interpretation of Topographic Maps*, 1908; *Glaciation of the Uintah and Wasatch Mountains*, 1909; *Mineral Re-*

*sources of Southwestern Alaska*, 1910; *Geology and Mineral Resources of the Alaska Peninsula*, 1911, and *New Geography*, 1920. In 1925 he founded and became editor of *Economic Geography*.

**AUBER, DANIEL-FRANÇOIS-ESPRIT** (1782-1871), French opera composer, was born at Caen, Jan. 29, 1782. LUIGI CHERUBINI, whom he succeeded as director of the Paris Conservatory in 1842, early recognized Auber's talent which he guided and which resulted in 1820 in the pupil's first public success, *La bergère châtelaine*. During the next fifty years Auber composed 48 operas, laying the foundation of French comic-opera with scores admirable for their sparkle and polish, and in *Masaniello, ou la muette de Portici*, produced in 1828, creating a more serious opera form, highly praised by RICHARD WAGNER. Virtually none of his works is heard to-day, but his position in the development of French opera is important historically. He died at Paris, May 13, 1871.

**AUBERVILLIERS**, a northern suburb of Paris. In medieval times it was a place of pilgrimage. Chemical products and cardboard are among the local manufactures. Pop. 1931, 55,714.

**AUBURN**, a city in northeastern Indiana, the county seat of DeKalb Co., about 20 mi. northeast of Fort Wayne. It is served by four railroads. The city manufactures rubber soles and stamps, tires, lumber products, postcards, office filing systems, steel products and automobiles. Auburn was founded and became the county seat in 1836. Pop. 1920, 4,650; 1930, 5,088.

**AUBURN**, a city of southwestern Maine, the county seat of Androscoggin Co., situated on the Androscoggin River opposite Lewiston, about 35 mi. north of Portland. An electric line and two railroads afford transportation. Auburn and Lewiston, with abundant water power, form one of the largest manufacturing centers in the state. Shoes are the chief item in Auburn's manufacturing output, which was valued in 1929 at \$20,253,640. The retail business in 1929 amounted to \$5,803,019. Dairy and fruit farms, clay pits, feldspar and granite quarries are operated in the vicinity. Auburn was settled in 1786 and adopted a commission-manager form of government in 1917. Pop. 1920, 16,985; 1930, 18,571.

**AUBURN**, a town of Worcester Co., southeastern Massachusetts, situated about 4 mi. south of Worcester. Bus lines and the Boston and Albany and the New Haven railroads afford transportation. Auburn is primarily a residential suburb of Worcester. It was incorporated as a town in 1837. Pop. 1920, 3,891; 1930, 6,147.

**AUBURN**, a city of central New York, the county seat of Cayuga Co., situated on the Owasco River, an outlet of Owasco Lake, about 26 mi. southwest of Syracuse. It is served by the Lehigh Valley and the New York Central railroads. Auburn is beautifully located among wooded hills in the Finger Lakes region. There is good water power. The local manufactures include agricultural implements, boots, shoes and cotton and woolen goods. In 1929 the factory output was worth \$37,245,055. The retail business in

1929 amounted to \$21,995,481. A state prison, in connection with which is a women's prison, is located here. The City is the seat of the Auburn Theological Seminary, a Presbyterian institution. The mansion of W. H. Seward, Secretary of State during the Lincoln administration, is one of the local places of interest.

Soon after the close of the Revolution a settlement was made here. In 1793 Col. John L. Hardenburgh laid out the town, which was called Hardenburgh's Corners. The village was given its present name and made the county seat in 1805, receiving a city charter in 1848. Pop. 1920, 36,192; 1930, 36,652.

**AUCASSIN AND NICOLETTE**, the delightful 12th century French tale of the love of Aucassin, son of the Count of Beaucaire, and Nicolette, the fair captive of the King of Carthage. In a style which is at once naïve and artful, the story of the adventurous lovers is told in alternating verse and prose. Andrew Lang's translation is generally considered the best in English.

**AUCKLAND**, the largest city of NEW ZEALAND, situated in the northwestern part of North Island on Waitemata Harbor where the island is only a few miles wide, another harbor, Manukau, lying on the other side of the isthmus. Auckland is the port for mail steamers from Australia, Canada, Britain, the Pacific Islands and the East. The city has a large and increasing trade. It also distributes farm produce to the Old World markets, builds boats and railway cars and manufactures clothes, furniture, bricks, raw South Sea Island sugar, soap and machinery.

Auckland, called the Queen City, is the seat of a university. From 1840 to 1865 it was the capital of the Dominion; in the latter year Wellington was selected as being more central. Pop. 1931, 105,600.

**AUCTION PITCH**, a card game for from four to seven players, using a full deck with the cards ranking in descending order from the ace to the deuce. The player having cut the highest, deals six cards in 3's to each player. Bidding or auctioning begins with the player at the dealer's left who may pass or bid from one to four. The other players in rotation may pass or raise the preceding bid; but the dealer retains the privilege of refusing to sell for four and topping it with a four bid of his own. After the auction, the highest bidder leads, or pitches, a card of the suit that he wants to be trump. When all pass, the player at the left pitches the trump without any contracted obligation. In playing it is necessary to follow suit if possible and if not to trump or discard. Game is from 7 to 10 points as agreed upon, and scoring includes one point each for the holder of the highest and lowest trumps dealt, the trick containing the Jack of trumps, and the majority of cards. Should the bidder fail to make his bid, the amount he has contracted for is deducted from his score.

**AUCTIONS AND AUCTIONEERS**. An auction is a public sale of real or personal property, or both; an auctioneer is an agent who conducts the auction. The items to be sold and the conditions

governing the sale are announced on the spot either by printed pamphlet or by word of mouth, then bids are asked for and the auctioneer knocks down each item to the bidder who offers the highest price. The knocking down constitutes an acceptance of the bid, thus creating a CONTRACT between buyer and seller which is subject to the conditions of the sale as already announced. Until a bid is accepted by the auctioneer, it is not considered binding and may be withdrawn. After acceptance, a deposit of cash is required, the amount being a previously stipulated percentage of the selling price.

Auction sales are carefully regulated by statute in many States. The use of "dummy" bidders to raise the bona fide bids is prohibited. The seller, or an agent (*see* PRINCIPAL and AGENT) for him, not more than one man, may bid in an article which has not drawn a satisfactory offer, providing he has previously reserved that right as one of the conditions of the sale; otherwise, he must keep silent and the auctioneer must accept the highest bona fide bid. On the other hand, there can be no combination of bidders for the purpose of keeping the selling prices low. The auctioneer suspecting such a combination may refuse to accept bids and stop the sale. A sham auction, one conducted by conspirators who try to make it appear that a bona fide sale is being conducted and thereby induce the public to buy at high prices, is a criminal offense.

The auctioneer, as a rule, must have a license, either from the state or from the municipal authorities. During the bidding he is the agent of the seller. As soon as he accepts a bid, however, he becomes the agent of the buyer as well, his duty being the proper making out of a legal BILL OF SALE. He has a LIEN upon the goods he sells for his costs and his commission. He is liable with his principal for any breach in the performance of the contract and legal action may be instituted against them, either separately or jointly. If the goods he sells are stolen, he may be sued by the legal owner of the goods regardless of the fact that he sold in good faith and turned the proceeds over to the thief for whom he sold them. He is also liable for any damage the goods may have received while in his possession. He may not dispose of goods at private sale.

A Dutch Auction is a sale in which the auctioneer names the prices. Starting high, he lowers the sum until he receives an acceptance.

*See* J. Bateman, *Treatise on the Law of Auctions*.

**AUDIENCIAS**. *See* LATIN AMERICA.

**AUDIO FREQUENCY**, a FREQUENCY that is audible to the human ear. The upper and lower limits of audible frequencies vary with individuals, but they may be considered as being from 20 to 25,000 cycles per sec. In radio, it is considered adequate to reproduce the region from 60 to 5,000 cycles per sec., although some new equipment is being built to handle frequencies from 30 to 7,000 cycles.

**AUDIT AND AUDITOR**. The purpose of an audit of business and accounting records is to verify

their correctness, both from the standpoint of what is shown thereon and from that of the items omitted therefrom. Error in either regard makes the record incorrect. Specifically the purposes of an audit may be stated as four-fold: to ascertain the real condition as to financial status and earnings; the detection of errors, both errors of principle and clerical errors; the detection of fraud; and—as an outgrowth or corollary of the second and third—the prevention of fraud and error. The services involved in the first item may be rendered for the information of the owners and executives of a business, e.g., stockholders, officers and directors; creditors or prospective creditors, e.g., vendors of merchandise, commercial and investment bankers and note brokers; those contemplating gifts to educational, charitable and other institutions; and those holding profit-sharing, royalty or other similar relationships to a business. With regard to the character and scope of the service to be rendered, audits may be classified as balance sheet audits; detailed audits; cash audits; cost audits; and investigations of various kinds such as the sale or purchase of a business, construction of new enterprises, reorganizations and receiverships, market and other surveys.

The auditor is a professional ACCOUNTANT who conducts audits. Auditing is one of the types of service—usually the most important—performed by public accountants. The term company or private auditor, refers to a regular company official whose major duties are concerned with auditing the records of his own company, particularly where there is a complex organization such as factory, branches and selling agencies. The title, auditor, does not have as well defined meaning in private employ as in public.

R. B. K.

**AUDUBON, JOHN JAMES** (1785-1851), American ornithologist, was born at Les Cayes, Santo Domingo, Apr. 26, 1785. His father, a wealthy plantation owner, sent the boy to Paris to study under the artist David. Returning in 1798, young Audubon settled on Mill Grove Farm, near Philadelphia, where he collected, studied and drew natural history specimens. In 1808 he married, and the next decade was spent, mainly in Kentucky, in repeated and futile efforts to establish himself in business. Audubon himself confessed to neglect of everything but his passion for the study of wild life. At last he collected enough money to go to England in 1826. After securing some subscribers, he began 4 years later the publication in folio form of the *Birds of America*, later called "the most magnificent monument raised by art to ornithology." This work, completed in 1838, contained 435 plates, the reading matter being published separately in Edinburgh. Audubon returned to America in 1840, and after considerable travel in the United States and Canada, settled on an estate along the Hudson River, and now included in the New York City boundaries as Audubon Park. Here in 1846-54 the great ornithologist worked on his *Quadrupeds of America*, which was completed by his sons, Victor and John Woodhouse. During his

last years Audubon's mind failed. He died at home, Jan. 27, 1851, and is buried in Trinity Cemetery, New York City.

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**AUDUBON**, a borough of Camden Co., N.J., situated 4 mi. southeast of Camden on the Atlantic City railroad and on the White Horse Pike. While mainly a residential suburb of Camden and Philadelphia, Audubon has several industries, including the manufacture of wire, cloth and concrete blocks. It was incorporated as a borough in 1905. Pop. 1920, 4,740; 1930, 8,904.

**AUDUBON SOCIETY**, an organization officially known as The National Association of Audubon Societies for the Protection of Wild Birds. It is an endowed body, the objects of which are to interest the public in the preservation of wild bird and animal life in America, in the protection of nongame birds and of game birds in danger of extinction, and to diffuse knowledge and information on wild life. The organization was founded in 1886 by George Bird Grinnell and was incorporated in 1905. It attaches much importance to the education of children in the value of bird life.

**AUE, HARTMANN VON.** See HARTMANN VON AUE.

**AUENBRUGGER, LEOPOLD** (1722-1809), Viennese physician, was born at Gratz, Styria, Nov. 19, 1722. He introduced the method of percussion in medical practice, by which the chest or any portion of the body is tapped and by the sound produced the physician is enabled to judge the condition of the tissues beneath. Auenbrugger's book, entitled, *New Invention for Discovering Obscure Thoracic Diseases by Percussion of the Chest* was published in 1762, but attracted little attention until translated and illustrated by the French physician Corvissart in 1808. In 1828 the method was brought into prominence by the physician Piorry, who introduced his pleximeter for mediate percussion, which intensified the sounds.

M. F.

**AUER, LEOPOLD** (1845-1930), Hungarian violinist and pedagogue, was born in Veszprem, June 7, 1845. A pupil of JOSEPH JOACHIM, he first acquired renown as a virtuoso, being appointed court soloist to the czar in 1868 and succeeding Wieniawski at the St. Petersburg Conservatory. Later he devoted himself chiefly to teaching, developing a large number of brilliant violinists, notably MISCHA ELMAN, JASCHA HEIFERTZ, Kathleen Parlow, and EFREM ZIMBALIST. He died at Dresden-Loschwitz, July 15, 1930.

**AUERBACH, BERTHOLD** (1812-82), German novelist, was born at Nordstetten, Württemberg, of Jewish parentage, Feb. 28, 1812. He studied at the universities of Munich and Heidelberg, and prepared for the ministry, but the reading of Spinoza's philosophy changed his ideas and turned him to literature. His first book was *Life of Frederick the Great*, 1836.

In 1837 he published *Spinoza, a Semi-Biographical Novel*, followed by a translation of Spinoza's works. In 1842 he made an effort to popularize philosophy in *The Clever Townsman*. Though Auerbach's reputation was established with his first novel, *On the Heights*, he is remembered chiefly for his stories, *Village Life in the Black Forest*, 1843-48. He died at Cannes, France, Feb. 8, 1882.

**AUGEAN STABLES**, the stables of Augeas, King of Elis, who possessed an enormous number of cattle, among them 12 white bulls sacred to Helios, the sun god. Hercules was bidden by Eurystheus to clean out from these stables in one day the accumulated filth of years. Hercules was able to accomplish this by diverting the rivers Alpheus and Peneus into the stables.

**AUGIER, GUILLAUME VICTOR ÉMILE** (1820-89), French dramatist, was born at Valence, Drome, Sept. 17, 1820. He studied law, but in 1844 when his first comedy, *La Cigüe*, was successfully produced at the *Théâtre de l'Odéon* in Paris, turned to the stage. His early plays were in verse, but as realism supplanted his romanticism, so a witty and robust prose took the place of his dramatic verse. His work as a whole gives an excellent picture of the bourgeois society of the Second Empire. Among his best known plays are *Mariage d'Olympe*; *Lions et Renards*; *Madame Coverlet*; *Gabrielle*; *Le Gendre de M. Poirier*, with Jules Sandeau; and *Les Fourchambaults*, 1878, with which Augier closed his dramatic career. He died at Croissy, Oct. 25, 1889.

**AUGITE**, the common rock constituent of the PYROXENE group of minerals, comparable to HORN-BLENDE of the AMPHIBOLE series. It is the metasilicate of calcium, magnesium, iron, aluminum and sometimes sodium, varying from black to dark green or brown in color. When well crystallized augite usually occurs in short prismatic crystals of nearly rectangular or octagonal cross-section, whereas HORN-BLENDE forms longer blades of a lozenge-shaped cross-section. It may change to hornblende through prolonged pressure. Weathering alters it to serpentine and chlorite. Augite is the commonest pyroxene in IGNEOUS ROCKS, is common in metamorphic ones, and is typical of the basaltic rocks and lavas. *See also* METAMORPHISM; PETROLOGY.

**AUGMENTATION**, in musical HARMONY, refers to the increasing distance between two tones, effected either by raising the second note a half-tone with the use of a sharp, #, or a natural, ♮, placed before it, or by lowering the first note a half-tone, preceding it with a natural, ♮, or a flat, ♭, according to the key in which the music is written. Such musical symbols are called accidentals, since they do not occur in the signature of the piece. In FUGUE augmentation results by broadening the imitating voice so that it is played or sung at least twice as slowly as the leading part. Augmentation is valuable in giving emphasis to a melody as, for example, the lengthening of the Pilgrims' Chorus theme at the finish of the *Tannhäuser Overture*.

**AUGMENTED INTERVAL**, in music; *see* AUGMENTATION; INTERVAL.

**AUGSBURG**, a Bavarian city situated at the confluence of the Wertach and the Lech rivers about 34 mi. northwest of Munich. It has risen to importance as an industrial center, having 21 textile plants and a number of machine construction works. The churches, mostly Gothic, and the elaborate Renaissance secular structures of the 16th and 17th centuries give the city a medieval aspect and recall its former greatness. Its fountains are famous for their beauty. Outside the gates are spinning and weaving mills and factories. Among the churches is the cathedral, the earliest part of which dates from 994 to 1006. The rathaus is notable. The former episcopal residence is now a government building. The city was founded by the Romans in 9 A.D. and was the seat of a bishop in the 4th century. After 1276, it was a free imperial city and the traffic between Italy and the Levant and northern Europe passed through it. It reached a height of prosperity in the 15th and 16th centuries. Pop. 1925, 165,530.

**AUGSBURG, CONFESSION OF**, the most celebrated creed of the Lutheran churches. The Confession was prepared by Melancthon, in consultation with Luther and other reformers, and read before the Diet of Augsburg in Bavaria, June 25, 1530. Twenty-one of the 28 articles set forth the main doctrines believed by the Lutherans, and the remainder sought to refute certain Roman Catholic practices. An answer by the Roman Catholic clergy was read Aug. 3, 1530, but with the promulgation of the Lutheran reading the hope of changing the Roman Catholic position was given up and complete division was established. The Diet was convened at Augsburg by Charles V to settle religious disputes in Germany and prepare war against the Turks.

**AUGURY**, substantially another name for DIVINATION, but frequently used in a general sense of promise of fair outcome for any reason, as in the phrase: "it augurs well." The Roman institution of the College of Augurs gave the practice standing and developed a system. Augury reads the omens or signs of good or ill fortune of a venture in the heavens, in the flight of birds, in the appearance of entrails of animals sacrificed, in the flight of arrows and in many another natural event or artificially devised code of signs.

**AUGUSTA**, a city in northeastern Georgia, county seat of Richmond Co., situated at the head of navigation on the Savannah River, 110 mi. northwest of Savannah. Bus and truck lines, steamships and six railroads afford transportation. The Raleigh H. Daniel Airport is located here. The principal crops of the region are cotton and corn. Augusta is a manufacturing center, producing cotton and lumber products, automobile tires and fertilizers. In 1929 the factory output reached an approximate total of \$26,000,000, the retail trade amounted to \$24,122,901. It is an important cotton market. The city was an old trading post of the Cherokee Indians, settled by



James Edward Oglethorpe in 1735, incorporated in 1798. At the beginning of the American Revolution, the inhabitants were loyalists. Nevertheless, both the Land Court confiscating loyalist property and the convention ratifying the constitution met here. Augusta is a beautiful city, and very quaint, a popular winter resort. Among the buildings of historic interest are St. Paul's Church, the First Presbyterian Church, and the manse which was Woodrow Wilson's boyhood home. The chimney of the Confederate powder mill still stands. Pop. 1920, 52,548; 1930, 60,342.

**AUGUSTA**, the capital city of Maine and county seat of Kennebec Co., on the Kennebec River, 62 mi. northeast of Portland. It is served by Maine Central Railroad, electric railways, and also by bus lines and an airport. There is a 1,000-foot bridge across the Kennebec and a dam which furnishes 4,500 horse-power electric energy. The manufactures are notably paper, cotton goods and shoes; important printing and publishing enterprises, lumber mills and other diversified industries are located here. In 1929 the manufactures reached approximately \$11,000,000; the retail trade amounted to \$9,063,310. Apples, produce, dairy products and grain are raised; near-by lakes furnish excellent fishing.

Augusta was settled as a Plymouth Colony trading-post on the site of an Indian village about 1628 and abandoned about 1661; in 1754, Fort Western, now restored as a museum, was erected; a post-office was built in 1794; three years later the town was incorporated as Harrington and the same year renamed Augusta. The city was chartered in 1849. Fort Western is associated with such historic names as BENEDICT ARNOLD, AARON BURR, PAUL REVERE and JAMES G. BLAINE. Charles Bulfinch designed the state capitol in 1829; near by is a state hospital for mental diseases, established in 1834. Pop. 1920, 14,114; 1930, 17,198; 20% foreign-born.

**AUGUSTANA COLLEGE**, at Sioux Falls, S.D., a coeducational institution founded in 1860 by the United Norwegian Lutheran Church of America. Originally located at Chicago, it was moved several times and finally settled in Sioux Falls. In 1930 there were 513 students and a faculty of 34, headed by Pres. O. J. H. Preus.

**AUGUSTANA COLLEGE AND THEOLOGICAL SEMINARY**, at Rock Island, Ill., was founded by the Evangelical Lutheran Augustana Synod of North America in 1860. Though primarily intended as a theological seminary, the institute now includes the regular college curriculum and is coeducational except in its theological department. The productive funds in 1931 were \$1,000,295. The library of 54,994 volumes contains an historical collection of American Lutheran and Scandinavian American literature. In 1931-32 there were 802 students enrolled, and a faculty of 54, headed by Pres. Gustav A. Andreen.

**AUGUSTINE, ST.** (354-430), bishop of Hippo and celebrated theologian, was born at Tagaste in

Roman Numidia, now a part of eastern Algeria, on Nov. 13, 354. His father, Patricius, was a pagan; his mother, Monica, a Christian who endeavored to instill religious principals in her son, although his baptism was postponed. At school, in Tagaste and near-by Madaura, where the study of Latin replaced his native Punic tongue, Augustine's unusual gifts of intellect were soon evident. His father was determined that he should have the advantage of studying at Carthage. The necessary funds were finally obtained through a generous patron, after a year of idleness which undoubtedly weakened Augustine's character. When he reached Carthage in 370 he was dazzled by the brilliance of the great city and gave himself up to licentiousness. Having contracted a liaison with a young girl of the city he was the father, at 17, of a boy whom he named Adeodatus (gift of God). It was perhaps his love for the son who inherited his splendid intellect that kept him faithful to his mistress for 15 years.



ST. AUGUSTINE  
From an engraving by Martin Schongauer

Augustine now turned from law to philosophy, but was led astray by the heretical Manichaean doctrine. Having taught grammar in Tagaste, and rhetoric in Carthage, he went to Rome in 383 to open a school of eloquence. After a year he went on to Milan where he was given a professorship. The young intellectual quickly came under the spell of the great St. Ambrose, bishop of Milan. Here, too, he was introduced to the writings of Plato and of Plotinus which influenced him so profoundly. His widowed mother, bent upon regularizing his life, chose for him a young girl of 12 who was to be his wife after two years. The unfortunate concubine was despatched to Africa. Meanwhile Augustine replaced her by another.

His conversion came most dramatically in 386. On hearing of the influence of a Life of St. Anthony of Egypt on two military men he was overcome with remorse for his own sinful life. Later while talking with his friend Alypius, he beheld, as in a vision, "the chaste dignity of continence—serene in cheer." Going into his garden he suddenly heard the voice of a child, saying "Tolle, lege; tolle, lege" (Take up and read). When he entered his house and picked up the Scriptures his eye fell upon the following passage in St. Paul's Epistle to the Romans: "Put ye on the Lord Jesus Christ and make not provision for the flesh, to fulfill the lusts thereof." In 387 he and his son were baptized by St. Ambrose. The party were returning to Carthage when the devoted Monica fell ill and died at Ostia. Their last days together form a touching part of the *Confessions*, that marvel-

ous human document by which Augustine is most widely known, written by him probably between 397 and 400.

After a short stay in Carthage Augustine retired to Tagaste, where his son died. Giving his small patrimony to the poor he founded a monastery which was the cradle of the Augustinian Order. He went to Hippo in 391 and was ordained a priest. In 396 he was named as assistant to Valerius, the aged bishop, and was consecrated. As bishop of Hippo, a small city on a site near the present town of Bona, he valiantly combated the Manichæan, Donatist, and Pelagian heresies. His sermons, many of them preserved in a stenographic form, and his letters, 270 in number, indicate a rare combination of tenderness of heart and brilliance of intellect. So important are his pronouncements on the doctrines of free will and grace that he is frequently called the Doctor of Grace. From 413 to 426 he was busy with his most important work, *De Civitate Dei* (The City of God), in which he originated a Christian philosophy of history. As a theologian Augustine is revered by Catholics and Protestants alike.

Augustine died at Hippo, on Aug. 28, 430, while the city was being besieged by the Vandals under Gaiseric, who conquered and destroyed it about a year later.

**AUGUSTINE, ST.** (?-604), "the Apostle of the Anglo-Saxons," sometimes called St. Austin of Canterbury, appears first in history as prior of St. Andrew's monastery, Rome. The date of his birth is unknown. In 597 Pope Gregory I sent him as a missionary to Kent, England, and three years later he was consecrated England's first archbishop. He died at Canterbury on May 26, 604. A hospital now stands in Canterbury on the alleged site of his tomb.

**AUGUSTINIAN CANONS**, a clerical order within the order of canons regular, originating in the 12th century. The clerics were also called Austin Canons and in England, Black Canons. They followed the Rule of St. Augustine (354-430), a mode of life said to have been established by him in his cloister at Hippo, where he lived "in humility and the community of goods." The order was exempt from the stern discipline and often rough clothes of the monks, and undertook preaching, the visitation of the sick and administration of the sacraments, and generally labored in clothes respectable in appearance, following the custom of St. Augustine.

**AUGUSTINIAN HERMITS**, a religious order generally called Augustinians. In the first Christian centuries, especially in Italy, individuals sought solitude for religious meditation in forest and desert. From time to time they were gathered into religious institutes and congregations under a superior and a fixed rule. In the 13th century several such monastic societies were combined by Pope Alexander IV and named the Hermits of St. Augustine, their first meeting being convened in 1256. The work of the Order is the propagation of the faith and the advancement of learning. Since the Protestant Reformation it has

lost numbers, but is active to-day, especially in Ireland and America, in about 100 places.

**AUGUSTINIANS.** The so-called "Rule of St. Augustine" is derived from a letter to a community of nuns and a sermon descriptive of the life of his clergy. Within this rule the Pope gathered small communities of hermits, living in central Italy during the 13th century and who, ceasing to be hermits, became known inaccurately as "Black Friars." In 1059 the Lateran synod urged the cathedral clergy to unite under some rule of common life, whence arose the Order of Augustinian Canons. At the Reformation there were 200 of these societies in England. Some of them survive in Austria.

**AUGUSTUS** (63 B.C.-14 A.D.), the title conferred in 27 B.C. upon Caius Octavius, by adoption, Caius Julius Caesar Octavianus, first Roman Emperor. He was born at Rome, Sept. 23, 63 B.C., the grand nephew of Julius Caesar, and it was chiefly from this relationship that Octavian reached the Imperium. Octavian already held a prominent, though unimportant, position in Caesar's entourage, when the latter's assassination in 44 B.C. left his followers with no clear leadership; Rome was in political confusion and Octavian was Caesar's adopted heir. He hurried to Rome from Apollonia and after a year of intrigue and confusion the political lines of the Roman world crystallized into two groups: Antony, Octavian and Lepidus formed a triumvirate holding the capital and western provinces, while Brutus and Cassius, supported by remnants of the Roman financial magnates and a few doctrinaire republicans held the east. Far more through the ability of Antony than through that of Octavian, Brutus and Cassius were forced into battle and killed at Philippi in 42 B.C. For ten years thereafter a precarious peace lasted between Octavian and Antony. Lepidus was eliminated as a political factor in 36 B.C. and Octavian held all the west, while Antony, though married to Octavian's sister Octavia, lived in Egypt, passionately in love with Cleopatra, and serving as a focus for the discontent of the east. The disunion finally brought war and the utter rout of Antony in the naval battle at Actium, 31 B.C. and a year later his suicide at the capture of Alexandria.

Octavian was left alone as the official master of the Roman world. In 27 B.C. the Senate conferred on him the title Augustus. Gradually most of the offices of the Roman Republic were bestowed upon him for life, princeps, tribune, consul, imperator (originally merely an emergency military command), and finally after the death of Lepidus, pontifex maximus, but this was in no sense the destruction of the Republic by a powerful dictator. The life of the Roman Republic had long since fallen into irretrievable ruin, only the empty forms remained, and the choice lay solely between continuing the forms while obtaining corruption, murder and civil war, or changing the forms in favor of a dictatorship. In this sense Augustus was the creature of his times and his entourage and not a master of both who carved out for himself a new and revolutionary line of action. In

fact Augustus was quite the reverse insisting that in reality he was the restorer of the republic. In foreign affairs Augustus was equally conservative, pinning the Roman frontiers at the points he found them save for the attempt of his able stepson, Drusus, to reach the Elbe. But with destruction of Varus's legions in 9 A.D. Augustus definitely gave up all hope of incorporating Germany in the Empire.

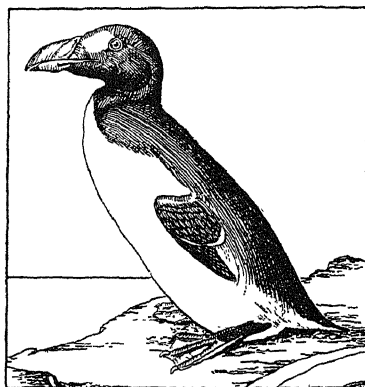
Though three times married Augustus left no son to succeed him. Both his nephews died before 3 A.D. and the death of Drusus left as his successor only a second stepson, Tiberius, with whom his relations were far from cordial, but whom he was at last forced to adopt as a son and recognize as a successor. Augustus died at Nola, Aug. 19, 14 A.D.

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**AUK**, a sub-tribe of the **TLINGIT**, an American Indian group speaking a language of the Koluschan stock, with its chief villages on Stephens Passage, Douglas and Admiralty islands. The site of one of their summer camps is now the town of Juneau, Alaska.

**AUK.** The family *Alcidae*, or Auks, includes the puffins, auks, auklets and murre, or guillemots, about 30 species, 21 of which are found along the coasts of North America, on both the Atlantic and Pacific. All are ocean-going birds, generally dark above and white beneath, with webbed feet, averaging about the size of a pigeon. The Puffins are also called Sea-parrots, from their large bills, flattened at the sides, and brilliant red in color. They lay their eggs in burrows in the turf. The Razor-billed Auk (*Alca torda*) of the North Atlantic with flattened bill smaller than that of the Puffins forms a link with the Murres which have longer, pointed bills. All members of the family lay large eggs, greatly varying in color.

The Great Auk, or Garefowl (*Plautus impennis*) about 30 inches long, black above and white beneath,



GREAT AUK

with a bill like the Razor-billed Auk, once took the place in the North Atlantic filled by the Penguins, also flightless birds, in southern oceans. Nesting in Newfoundland, Greenland, Iceland and the Faroe

islands, they swam as far south as Virginia and France in great numbers. But they were so extensively hunted for food on their breeding grounds that by 1844 they were extinct on both sides of the Atlantic. There remain of the Great Auk about 70 skins and as many eggs in museums.

C. J.

**AUKLET**, the name given to small oceanic birds of the auk family (*Alcidae*). There are six species, averaging about 9 inches long, dark above and lighter beneath, which breed in millions on rock ledges along the shores of the north Pacific, especially in the Aleutian islands and Alaska. The whiskered auklet (*Aethia pygmaea*) has a black crest curved forward and tufts of white feathers behind the eye, which give the bird its name; the least auklet (*A. pusillus*), 7 inches or less, a plainer bird, is the smallest of the group; the crested auklet (*A. cristatella*) has a curved crest; the rhinoceros auklet (*Cerorhinca monocerata*) has a horn on the red bill; the Cassin auklet (*Ptychoramphus aleuticus*) like the preceding, comes south to California in winter; the parakeet auklet (*Cyclorhynchus psittacula*), with a white crest behind the eye, likewise winters southward to California.

C. J.

**AULULARIA**, a comedy of miserliness by the Roman dramatist, **PLAUTUS** (c. 254-184 B.C.). The name of the play is derived significantly from *aulula*, meaning "a pot." Euclio, the central character, is one of the vividest in Latin comedy, and has become the archetype of the miser. Many modern dramatists—particularly **MOLIÈRE** in *l'Avare*—have been greatly influenced by the *Aulularia*.

**AURA**, a vaporous light or emanation surrounding the body which represents its double or astral aspect, and which becomes visible to psychically sensitive persons. This belief obtains among several orders of **OCCULT** phenomena. Theosophists claim to see such auras in color and form surrounding the head and indicative of the person's character traits. It is an instance of purely subjective phenomena, that cannot be verified. See also **ODYLLIC FORCE**.

**AURAMINE**, a brilliant yellow coal-tar color of the diphenyl-methane type, used in dyeing, prepared in several different ways. It crystallizes in yellow scales, melts at 267° C., and decomposes when heated in aqueous solution and when treated with acids. It is used directly in dyeing wool and silk, but cotton must be mordanted.

**AURELIANUS, LUCIUS DOMITIUS** (c. 213-275 A.D.), Roman emperor. During his brief tenure of imperial office from 270 to 275 he drove the Goths out of Moesia and across the Danube. Pursuing the same policy further west against Germanic tribes he secured the Rhine frontier. After a successful campaign against Zenobia, queen of Palmyra, who disputed Rome's control of Syria, he crushed Firmus, a pretender to the throne of Egypt, and Tetricus, who had irregularly assumed control of Gaul, Spain and Britain. As a protection against barbarian invaders he strengthened the defences of Rome, and the ruined walls bearing his name which even now gird the city are an impressive reminder of his work.

**AURIGA** (gen. *Aurigae*), the charioteer, a brilliant northern constellation nearly always visible, and passing overhead during early evenings in February. Alpha Aurigae, or **CAPELLA**, the brightest of its stars, is of the first magnitude. It is probably the best known star in the universe and the test object for many theories. Beta and Epsilon Aurigae are **ECLIPSING BINARIES**. In the former, the two stars are 114 million miles apart and revolve in 4 days, each star partially eclipsing the other once during that time. In the latter star 33 years elapse between eclipses. With Sirius and five stars of the Big Dipper Beta Aurigae forms part of the **URSA MAJOR CLUSTER**. See **STAR: map**.

**AURIGNACIAN CULTURE**, the oldest stage of the Upper **PALAEOLITHIC PERIOD**, following the Mousterian, or middle Palaeolithic, and followed by the **SOLUTREAN** and **MAGDALENIAN** of the Upper Palaeolithic. It is represented by discoveries at Aurignac, in the department of Haute-Garonne, southern France, and is marked by the appearance of new types of flint implements. These include knives, which are flakes of flint chipped along one or both margins; end-scrapers, with a chipped edge at the end of the blade; instruments of bone, horn and ivory, and flint of several types.

The Aurignacian stage marked the coming of a new race known as the **Cromagnon** people, tall, well-developed and large-brained, and the disappearance of Neandertal man. This new race is distinguished by artistic gifts, illustrated by engravings and drawings in color of men and animals, including the horse mammoth and reindeer and by sculpture. It is probable that the **Cromagnon** race came from Central Asia. A branch of Aurignacian culture entered Europe; another traversed northern Africa, and a third found its way down eastern Africa. See **ARCHAEOLOGY**.

**AUROCHS** (*Bos taurus primigenius*), a wild ox formerly abundant in northern Europe, but exterminated as a wild animal in the early part of the 17th century. Most of the domesticated cattle of Europe are believed to be descended from it. The aurochs was a large animal, standing 6 ft. or more at the shoulder; black in color; its horns had a characteristic curve outwards and forwards, then upwards and inwards, and sometimes reached a length of 5 ft. The ancient British breed of black Pembrokes closely resembles the aurochs, and the dwarfed, half-wild cattle of Chillingham and other British parks are an albino off-shoot. Another probable descendant is the Spanish fighting bull, which has the characteristic light-colored line along the spine.

**AURORA**, the Latin name for the goddess of the dawn, Eos.

**AURORA**, a city of Kane Co., northern Illinois, situated on the Fox River, 38 mi. west of Chicago. It is on several railroads and two Federal highways, and has an airport operated by the Mid-West Airways Corp. Aurora's manufactures include hardware, steel lockers and cabinets, conveying and road-building ma-

chinery, pumps, pneumatic tools and cotton materials. In 1929 the factory output was approximately \$30,000,000; the retail trade amounted to \$28,536,449. Nearby are limestone quarries and deposits of sand, gravel, clay and peat. Aurora is the home of an Advent Christian college, established in 1911. Points of interest in the vicinity are Devil's Cave and Mara-mech Hill, the latter a noted Indian battleground. Aurora was settled in 1834 and incorporated in 1857. A new monolithic bridge, crossing the Fox River, is one of the engineering sights of the city. Pop. 1920, 36,397; 1930, 46,589.

**AURORA BOREALIS**, or northern lights, a phenomenon often observed in high northern latitudes and generally appearing as a curtain-like formation of light. Rays and streamers may emerge from this curtain of light and reach as far as the zenith. Its appearance fluctuates rapidly, and may change completely in but a few minutes. When at its greatest intensity it may be visible over the entire sky, and its rays and streamers may unite in the zenith to form a corona borealis. Faint aurorae are usually white in color; brilliant displays greenish, often with a crimson afterglow. Recent investigations have shown the aurora borealis to be produced by electrical disturbances in the upper air, at an average altitude of around 100 miles, though some have been observed as high as 400-500 miles. The ultimate cause appears to lie in the sun-spots whose electrical radiations, in approaching the earth, are brought down in a curved path by the influence of the magnetic poles of the earth. A large sun-spot which causes a powerful magnetic storm on earth will nearly always produce a brilliant aurora. The zone of greatest frequency seems to be a belt 25° away from the magnetic north pole, at a latitude of about 70° in Europe and of 60° in America. It is probable that the source of the peculiar green hue of the auroral luminosity lies in the action of the electrical bombardment upon particles of oxygen and helium in the upper atmosphere, where the air is extremely cold as well as in a highly rarefied condition. The aurora australis, the southern counterpart, is less well known, merely because the land of the southern hemisphere does not reach far enough south to make it easily observable.

W. J. L.

**AUSABLE CHASM**, a deep narrow gorge of great scenic and scientific interest, situated about half-way between the Adirondack Mountains and Lake Champlain on the course of the Ausable River in northeastern New York State. The river at this point has worn a zigzag course through 2 mi. of hard Potsdam sandstone revealing numerous fault lines or displacements in the rock formation. At some points the chasm is 175 ft. deep.

**AUSDEHNUNGSLEHRE**, also called Calculus of Extension, a branch of analysis invented by Hermann Günther Grassmann (1809-1877) and made known through his work on the subject, published in 1844. It is related to **QUATERNIONS** in that some of the elements are vectors. See **VECTOR ANALYSIS**.

**AUSGLEICH.** After the overthrow of the short-lived Hungarian Republic in 1849, the Magyar state was forced once more to submit to joint rule with the Austrian possessions of the Habsburgs. This arrangement was exceedingly objectionable to the Magyars who, led by the practical and energetic Francis Deak, demanded a dual system of government whereby the independent political entities Austria and Hungary would be united only through the person of a common ruler and common ministries of war, finance, and foreign affairs. The exigencies of the Austro-Prussian War in 1866 made Emperor Francis Joseph amenable to the requests of the Hungarians, and in Feb. 1867, a compromise agreement, or *Ausgleich*, was negotiated.

By the terms of this agreement and of some supplementary decrees of 1868, the Emperor of Austria was always to be crowned separately as King of Hungary at Budapest. Croatia-Slavonia and Transylvania were confirmed as parts of the Hungarian kingdom. Each state was to have its own parliament and ministry, but the emperor-king was to appoint the joint ministry of foreign affairs, war, and finance. The work of this ministry was placed under the supervision of a joint parliament known as the Delegations sitting alternately at Vienna and Budapest. The 120 delegates were to be chosen annually, 60 by the Austrian Parliament, and 60 by the Hungarian. The two groups of delegates were always to meet in separate chambers and communicate in writing, except that upon failure to reach an agreement after three exchanges of written communications, the 120 members were to meet together for purposes of a final vote. Ten-year treaties, moreover, were to be entered into by the two states on matters relating to tariffs, trade, the public debt, and railways.

The compromise, which remained in force until the break-up of Austria-Hungary in 1918, was not wholly satisfactory, and there were fierce quarrels whenever the decennial arrangements had to be renewed. But from an economic point of view this union between industrial Austria and agrarian Hungary was highly desirable. See AUSTRIA-HUNGARY. W. C. L.

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**AUSSIG.** See USTI NAD LABEM.

**AUSTEN, JANE** (1775-1817), English novelist, was born in the village of Steventon, Hampshire, Dec. 16, 1775, the daughter of a clergyman. She grew up in an atmosphere of culture and good breeding, her father superintending her education. A quiet girl of domestic tastes, she began in her teens to occupy her leisure by writing of the provincial society in which she moved. Her chief companion was Cassandra, a sister three years her elder, and even after her genius was in part recognized Jane Austen had no literary friends. Her life, so uneventful, might have been commonplace and dull, except that it was enlivened by the sparkle of her own wit and ingenuity. In 1801 the family moved to Bath, remaining at this fashionable resort till 1809, when Mrs. Austen, Cas-

sandra and Jane removed to the village of Chawton, settling in a small cottage on the estate of Mrs. Austen's third son. Neither here, nor at Bath, nor at Steventon did Jane have a study in which to work, but produced her remarkable novels in full view of her family, as it were, and even of such friends and neighbors as chanced to come visiting while she wrote. Her first novel, *PRIDE AND PREJUDICE*, written when she was 21, was unpublished for 16 years; the next, *Sense and Sensibility*, waited 13 years for acceptance. A third, *Northanger Abbey*, also failed of appreciation from publishers. Not until after the publication of *Sense and Sensibility* in 1811 did the author do further creative work. *Mansfield Park*, *Emma* and *Persuasion* were written during 1811-16. All of Miss Austen's novels appeared anonymously, and *Northanger Abbey* and *Persuasion* were posthumous publications. The novelist died in Winchester, July 18, 1817.

Jane Austen's genius was strikingly original, and she was the first to enter the field of the novel of keen observation and faithful representation of life. Her materials were unsensational, ordinary, yet so keenly had she noted her country and village people and so cleverly set them down that they live as few characters in fiction do. Her delicate humor and irony lend charm to her writings; her style is clear, unpretentious, subtly measured to the occasion. The very quietness of the settings served to advantage, for a quiet background made every flash of her wit so much more effective. Jane Austen was the first writer to devise a technique whereby domestic life may be described, and her formula has served many of the outstanding novelists since her day. See also ENGLISH LITERATURE.

**BIBLIOGRAPHY.**—Goldwin Smith, *Life of Jane Austen*, 1890; William and R. A. Austen-Leigh, *Jane Austen, Her Life and Letters*, 1913; O. W. Firkins, *Jane Austen*, 1920.

**AUSTENITIC STEELS.** Iron has at least two allotropic forms, each possessing different crystal structure and properties. As ordinarily known, IRON is stable up to approximately 900° C. At higher temperatures the second condition, the gamma state, prevails. Likewise a steel differs in its properties according to which state of the iron prevails. In the gamma state, the steel is austenitic, and is characterized by being non-magnetic and very tough and ductile. It has the microstructure of a solid solution and cannot be hardened by quenching. A marked tendency toward hardening by working cold often exists.

It is practically impossible to prepare plain carbon steel that is completely austenitic, although vigorous quenching will retain a high percentage of austenite in high-carbon steels. The presence of alloying elements renders the austenitic condition stable at room temperature, either by a lowering of the transformation temperature or by rendering the steel sluggish toward change. All commercial austenitic steels are high in alloy content such as nickel and chromium in corrosion-resistant steels (see CHROMIUM STEELS), manganese in abrasion-resistant steels (see MANGANESE

STEELS), and nickel in INVAR and permalloy. The term austenitic is now applied to many alloys, which are far removed in properties from the primitive austenite of carbon steel.

H. S. R.

**AUSTERLITZ, BATTLE OF**, an engagement fought on the east bank of the river Littawa, in Moravia, Austria, 12 mi. southeast of Brünn, which was won by Napoleon I, against the forces of Austria and Russia, on Dec. 2, 1805. The Allied armies numbered 84,000, as against 70,000 French. At 8 A.M., Dec. 2, the Allies hurled five columns against Napoleon's right, proposing to cut off his line of retreat to Vienna, and outflank him. Foreseeing this project, the French Emperor simulated a slight retreat, and suddenly threw his forces against the Allied center, weakened by the advance of the five columns, breaking through and administering a crushing defeat. The Allies' casualties were 35,000; the French losses, 7,800.

**AUSTIN, ALFRED** (1835-1913), English poet, was born at Headingley, near Leeds, May 30, 1835. Graduating from the University of London, he became a member of the bar in 1857. For several years he edited *The National Review* and wrote both novels and poems. His appointment in 1896 as poet laureate of England to succeed Tennyson caused consternation and criticism because he was not generally recognized as a great poet. Among Austin's best works were nature poems such as *Veronica's Garden*. He also wrote *English Lyrics*, *The Human Tragedy* and *Prince Lucifer*. He died at Swinford Old Manor, Kent, June 2, 1913.

**AUSTIN, JANE GOODWIN** (1831-94), American writer, was born at Worcester, Mass., Feb. 25, 1831. Her stories appeared in *The Atlantic Monthly*, *Harper's Magazine* and other periodicals; a collection of these is entitled, *David Alden's Daughter and Other Stories*. Her *Pilgrim Books* give a faithful account of the life of early settlers in Massachusetts. Among her best known stories are *Mrs. Beauchamp*, *Moonfolk*, *Betty Alden* and *Fairy Dreams*. She died Mar. 30, 1894.

**AUSTIN, MARY HUNTER** (1868- ), American author, was born in Carlinville, Ill., Sept. 9, 1868, and educated at Blackburn University. After her marriage in 1891 to Stafford W. Austin, she lived in New Mexico, where she wrote about the history and lives of the surrounding Indian tribes. Her best known books and plays include *The Land of Little Rain*, 1903, *The Arrow Maker*, produced 1911, *Fire Drama*, *The Trail Book*, 1918, and *Lands of the Sun*, 1927.

**AUSTIN, STEPHEN FULLER** (1790-1836), American colonizer and, with his father, Moses Austin, the founder of Texas, was born at Austinville, Va., in 1790. His variety of experience and contacts with people of different nationalities in his youth made him particularly suited for his later work in organization and leadership. When he was five, his parents moved to the territory of Missouri, where he mixed with the French and Spanish settlers and in later

years became a storekeeper, manager of the lead mines, bank director, adjutant of the militia and legislator. Going to New Orleans, he studied law and did newspaper work. In 1821, he founded a colony in Texas, on the Gulf; in this he was carrying out the project of his father, who the year before had obtained permission from the Mexican government to found an American colony of 300 families in Texas. The older Austin died June 10, 1821, but his son accomplished his aim. He was forced to spend a year in Mexico, securing the ratification of his grant, which was given to him in Feb. 1823. For seven years, he was in supreme authority over the American colonies in Texas. Austin was imprisoned from Feb. 1834 to June 1835 by the Mexican government, while endeavoring to erect Texas into an independent state with self-government. The Texas revolution which followed upon his release was successful, due to the support of frontiersmen from the United States. The following year he was a candidate for the presidency of the Republic of Texas but Sam Houston won the election. Austin was serving as secretary of state under Houston when he died Dec. 27, 1836, at Columbia, Tex.

**AUSTIN**, a city in southeastern Minnesota, the county seat of Mower Co., situated on the Red Cedar River, 100 mi. south of Minneapolis. Two railroads and bus and truck lines afford transportation. The leading interests of the countryside are live stock and grain and dairy products. Meat packing, incubator chicken hatching and the manufacturing of flax fiber and overalls are carried on in the city. In 1929 the retail trade reached a total of \$7,266,505. The greenhouses supply roses to florists throughout the country. Horace Austin State Park lies within the city. Austin was founded about 1853 and incorporated in 1876. Pop. 1920, 10,118; 1930, 12,276.

**AUSTIN**, the state capital, a city in the southeastern part of central Texas, the county seat of Travis Co. It is situated on the bluff of Colorado River, 155 mi. northwest of Houston. Bus and truck lines and three railroads serve the city. The Robert Mueller Municipal Airport, occupying 133 acres, is 1 mi. northeast of the city. The state capitol, built of Texas red granite, stands in the center of the city. The embassy built by the French government in the days of the republic of Texas is an interesting landmark. Austin is the seat of the state university, St. Edward's College, Concordia College, Texas Wesleyan College and the Presbyterian Theological Seminary. State institutions for the blind, deaf, dumb, feeble-minded and insane are located here.

Austin has many industries, including the manufacture of food products, furniture, engines, machinery and cottonseed oil. In 1929 the total factory output was worth about \$7,000,000; the retail trade amounted to \$30,663,236. Austin was founded by Stephen F. Austin in 1839 as the capital of the republic. Pop. 1920, 34,876; 1930, 53,120.

**AUSTRALASIA**, the name applied in a restricted sense to the continent of Australia and its neigh-



boring islands of Tasmania, New Zealand and sometimes part of the islands of Melanesia. Broadly, Australasia includes a geographical area practically co-extensive with Oceania, i.e., the Pacific islands of Micronesia, Melanesia, Polynesia, and Indonesia or the Malay Archipelago. The islands included in the restricted interpretation have a political unity in that they are mandates or territories of the British Empire.

**AUSTRALIA**, an island continent lying south-east of Asia and the East Indies between the Indian and Pacific oceans, the only continent, with the exception of Antarctica, lying entirely south of the Equator. The island lies between  $10^{\circ} 39'$  and  $39^{\circ} 11'$  S. lat. and between  $113^{\circ} 5'$  and  $153^{\circ} 16'$  E. long. It is separated from Tasmania by Baas Strait, 140 mi. wide, and from New Guinea by Torres Strait, 90 mi. in width. The distance from Australia to North America is about 6,700 mi., and over 11,000 to England.

**Area and Population.** Australia has a breadth of 2,400 mi. from east to west, a length of 1,971 mi. from north to south, and a total area of 2,974,581 sq. mi. Pop. 1921, 5,436,734; est. pop. 1930, 6,438,999. The Commonwealth of Australia, a self-governing British dominion, was proclaimed on Jan. 1, 1901. It now consists of six states, one territory and a Federal district.

States and Territories	Area in Square Miles	Population June 30, 1929
New South Wales . . . . .	309,432	2,462,421
Victoria . . . . .	87,884	1,767,539
Queensland . . . . .	670,500	927,092
South Australia . . . . .	380,070	579,415
Western Australia . . . . .	975,920	411,734
Tasmania (island) . . . . .	26,215	212,512
Northern Territory . . . . .	523,620	4,170
Federal Capital District . . . . .	940	8,336
	<hr/> 2,974,581	<hr/> 6,373,219

Full-blood aborigines, owing to their nomadic habits, were not enumerated, but were estimated to number about 60,000. The peculiar distribution of Australia's population accounts for many difficulties in the country. Every state includes one large city with all the concurrent problems of a great port, an industrial community and a closely packed center of urban population. The oldest city, Sydney, with its surrounding suburbs, includes over a million people, half the population of the whole of New South Wales. Melbourne with its suburbs has one-half of Victoria. Similar conditions prevail in South Australia, Queensland and Western Australia, nearly 50% of the population in each being packed in one urban center and the remainder scattered over thousands of square miles of the interior, or what is known as the "back blocks." For several years Australian legislators have been faced with the difficulty of peopling the waste spaces of a continent to prevent overcrowding in urban slums. Since the close of the World War the government has devised immigration schemes to promote the growth of a rural population.

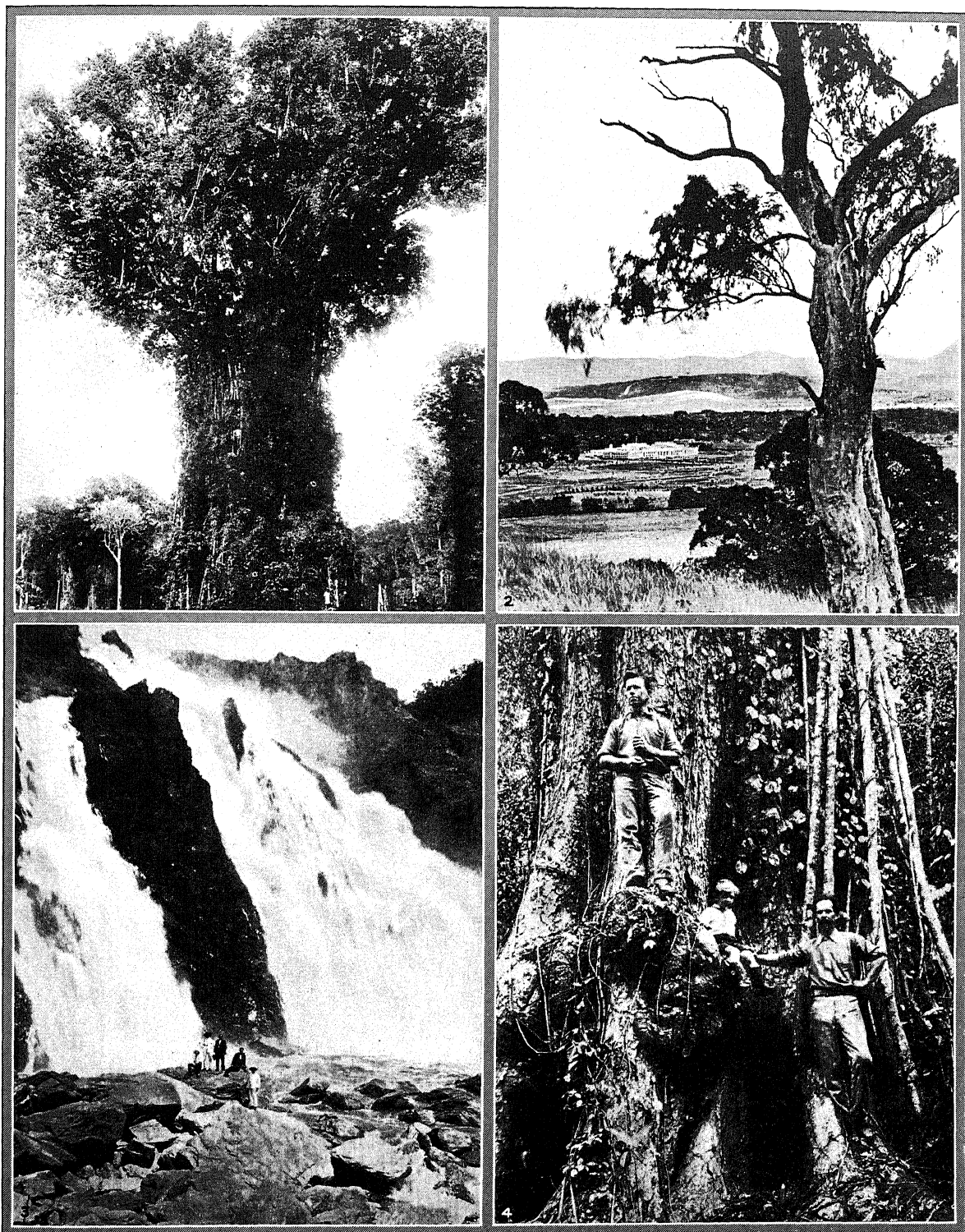
**Surface Features.** Australia is an immense plateau fringed by a low-lying, well-watered coast and with a barren interior. The main mountain feature is the great Dividing Range, which, starting in Queensland, runs parallel with and close to the eastern shore of the continent through New South Wales and Victoria. In the south, one branch of the range sweeps westward towards the boundary of Victoria and South Australia, and the other, the main branch ends in Tasmania, which is almost covered by ramifications of the range. The greatest height attained is in the Australian Alps in the southeastern part of the continent, where Mount Kosciusko reaches an altitude of 7,323 ft. The Dividing Range receives various sectional names in the states through which it passes. The seaward slope of the range is generally sharp and precipitous, and in places marked by extensive chasms and lofty precipices. Inland the descent is more gradual, merging by easy degrees into the great plains. In South Australia a chain of mountains runs northward from Adelaide and terminates in the Flinders Range, near Lake Torrens, and the plateau in Western Australia is traversed by ranges in various localities. The continent has no great contrast in elevation.

For a discussion of the geology and additional details regarding the physiography of the continent, see Sir Edgeworth David, "The Geology of the Commonwealth," in the *Federal Handbook*, B. A. A. S., 1914; C. H. Barton, *Outlines of Australian Physiography*; G. Taylor, "The Topography of Australia," in *Commonwealth Year Book*, No. 20.

**Rivers.** There are very few navigable rivers in Australia. The River Murray drains a considerable part of Queensland, the major part of New South Wales and a large part of Victoria. About 570 mi. from the sea as the river runs, the Murray is joined by the Darling and the total Darling-Murray length is 3,282 mi. Although this is not a continuous course, much of it is navigable in wet seasons by stern-wheel steamers drawing barges. The chief Murray tributaries, beside the Darling, are the Murrumbidgee and Lachlan, which drain the western part of New South Wales. Of other New South Wales rivers, the Hunter drains about 11,000 sq. mi. and empties at Newcastle. The Burdekin, Fitzroy, Burnett, Mary and Brisbane are the largest rivers of Queensland. The Latrobe, Yarra, Hopkins and Glenelg are in Victoria. Some of the rivers flowing into the sea on the northwest coast of Australia are of considerable size. On the northern coast the Roper, estimated to drain 90,000 sq. mi., is navigable for large vessels for 75 mi. Very few fresh water lakes, and none of any size, exist in Australia. The term is usually applied to shallow depressions of mud which fill with water after rain. Lake Eyre, on the central plains, usually has some salt water in its southern arm, but the remainder is a vast salty plain formed from alluvium carried down by the rivers which now enter it only in flood time.

**Climate.** The seasons begin about Mar. 21 (autumn), June 21 (winter), Sept. 22 (spring), and Dec. 22 (summer). The climate may generally be

## AUSTRALIA

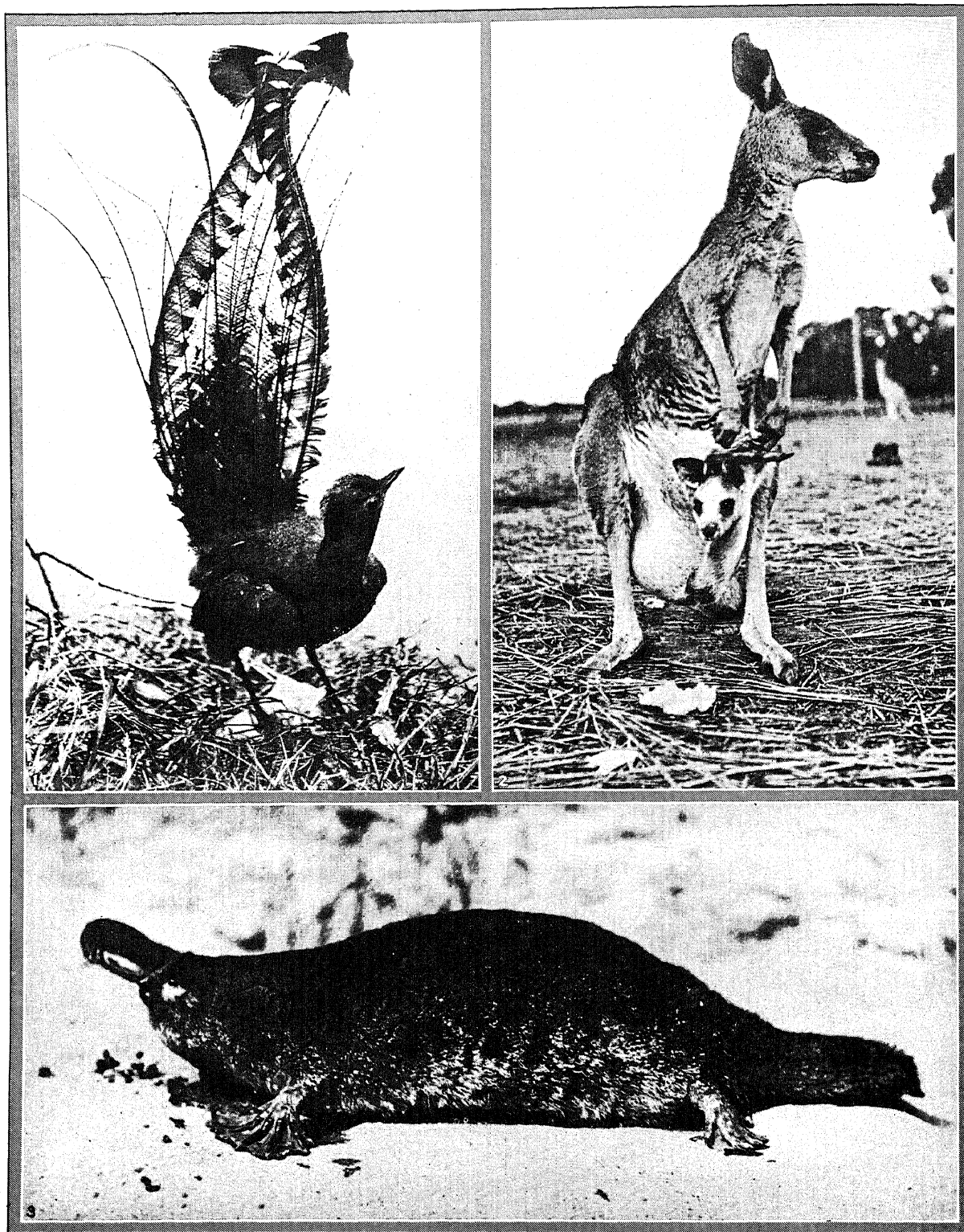


COURTESY COMMISSIONER GENERAL FOR AUSTRALIA, NEW YORK

### AUSTRALIA—A LAND RICH IN NATURAL RESOURCES

1. A giant fig tree in Queensland, 200 ft. high. 2. Canberra, the Federal capital of Australia. 3. Barron Falls in Queensland, a drop of 700 ft. 4. A giant cedar valued at \$1700, growing on a settler's property at Yungaburra, north Queensland.

## AUSTRALIA



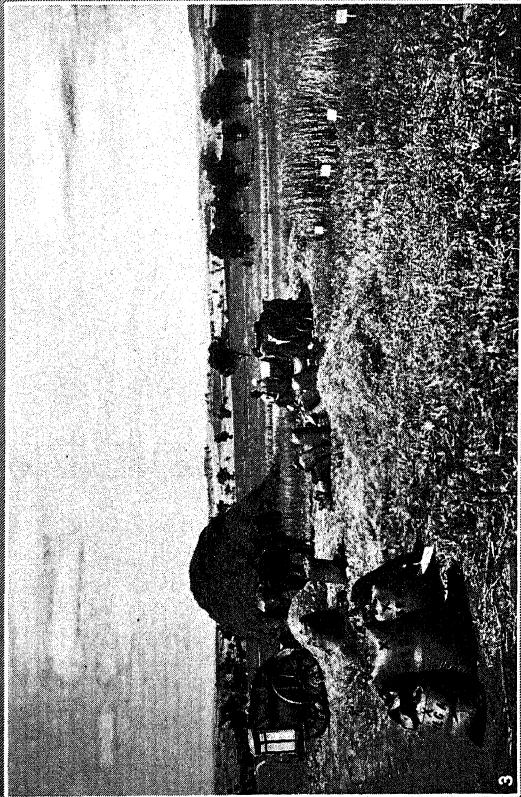
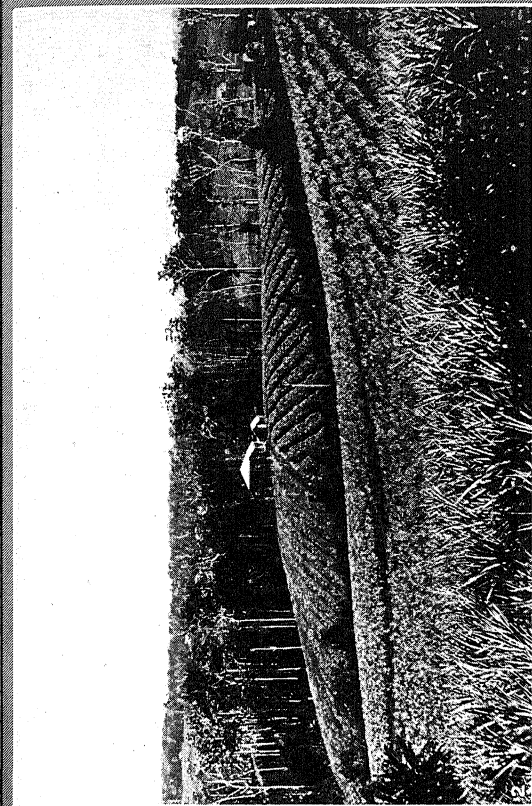
COURTESY AUSTRALIAN NATIONAL TRAVEL ASSN.

### AUSTRALIAN WILD-LIFE

1. The lyre-bird, remarkable for its plumage and ability to mimic. 2. The national animal of Australia—a mother kangaroo and her young. 3. The duck-billed platypus, an aquatic mammal.



# AUSTRALIA

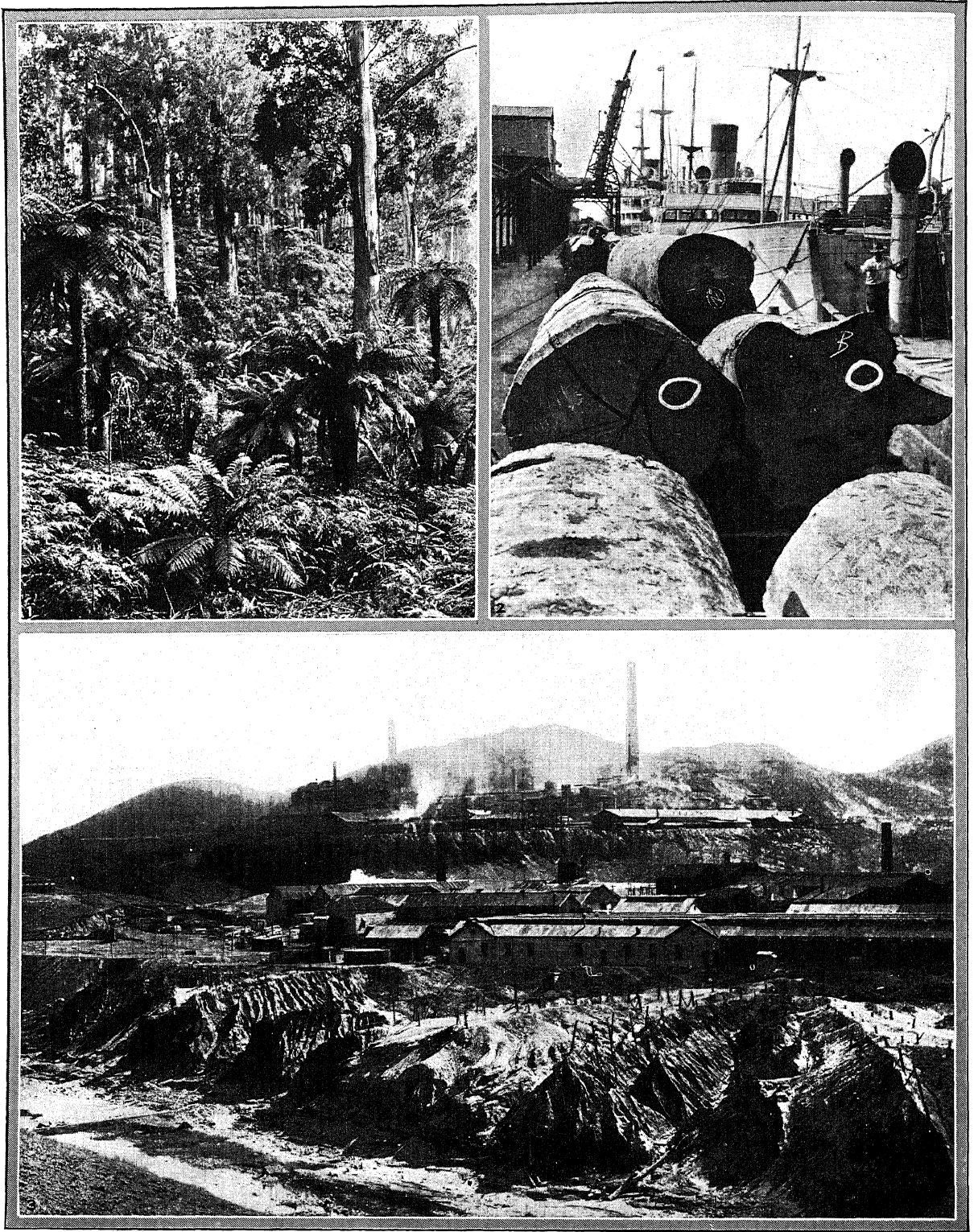


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## AGRICULTURE AND TIMBER PRODUCTION IN THE AUSTRALIAN COMMONWEALTH

1. Haystacks on one of the stock-breeding farms in South Australia.
2. Pineapple plantation in the Nambour District, south Queensland.
3. Government Agricultural Experimental Station, New South Wales.
4. Unloading hoop pine logs, drawn by oxen, in Queensland.

## AUSTRALIA



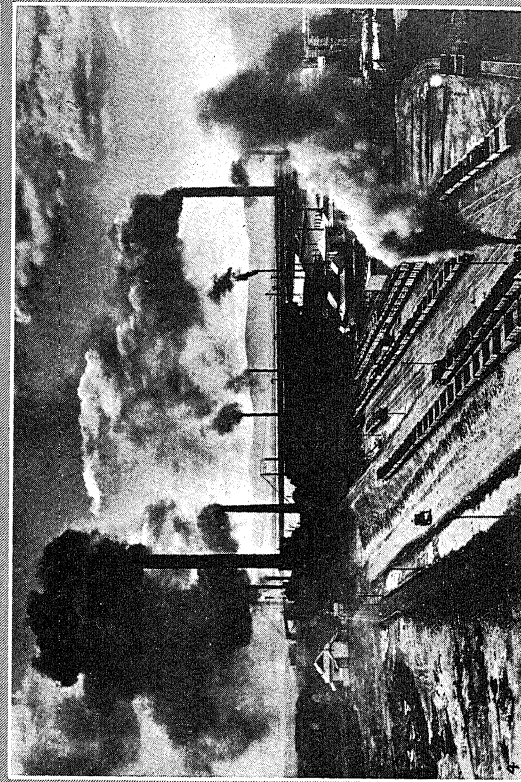
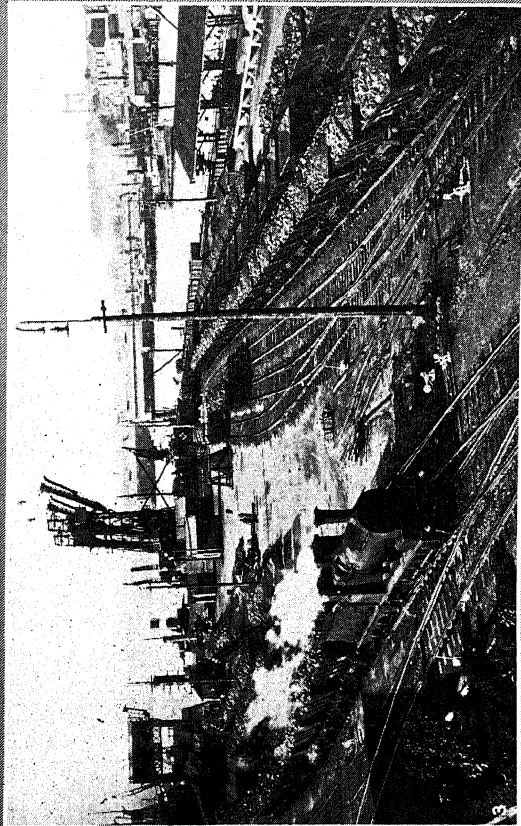
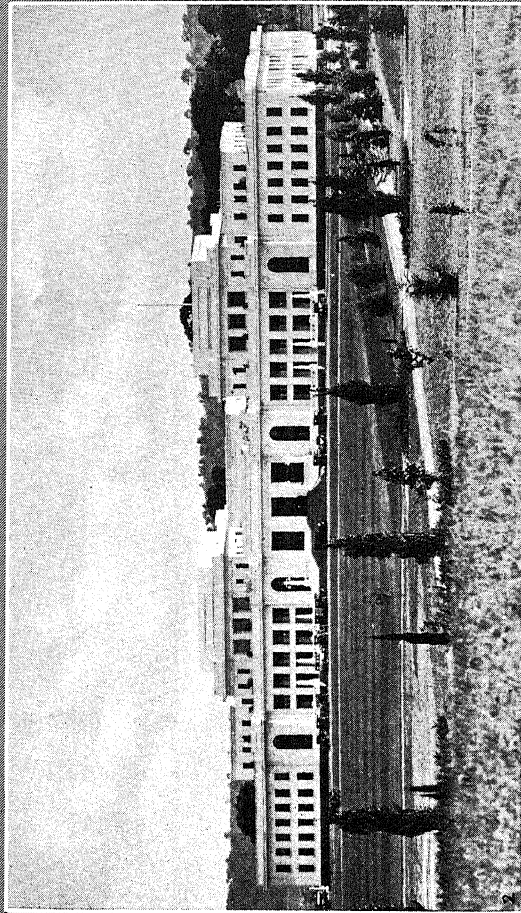
1. COURTESY AUSTRALIAN NATIONAL TRAVEL ASSN.; 2. PHOTO FROM SYDNEY MORNING HERALD; 3. COURTESY COMMISSIONER GENERAL OF AUSTRALIA

### GLIMPSES OF AUSTRALIAN FOREST, PORT AND MINE

1. Tree ferns and eucalypts in the tangled undergrowth of the Australian bush. 2. Large maple and mahogany logs on the Sydney wharves ready for export. 3. Gold and copper mine at Mt. Morgan, Queensland.



# AUSTRALIA



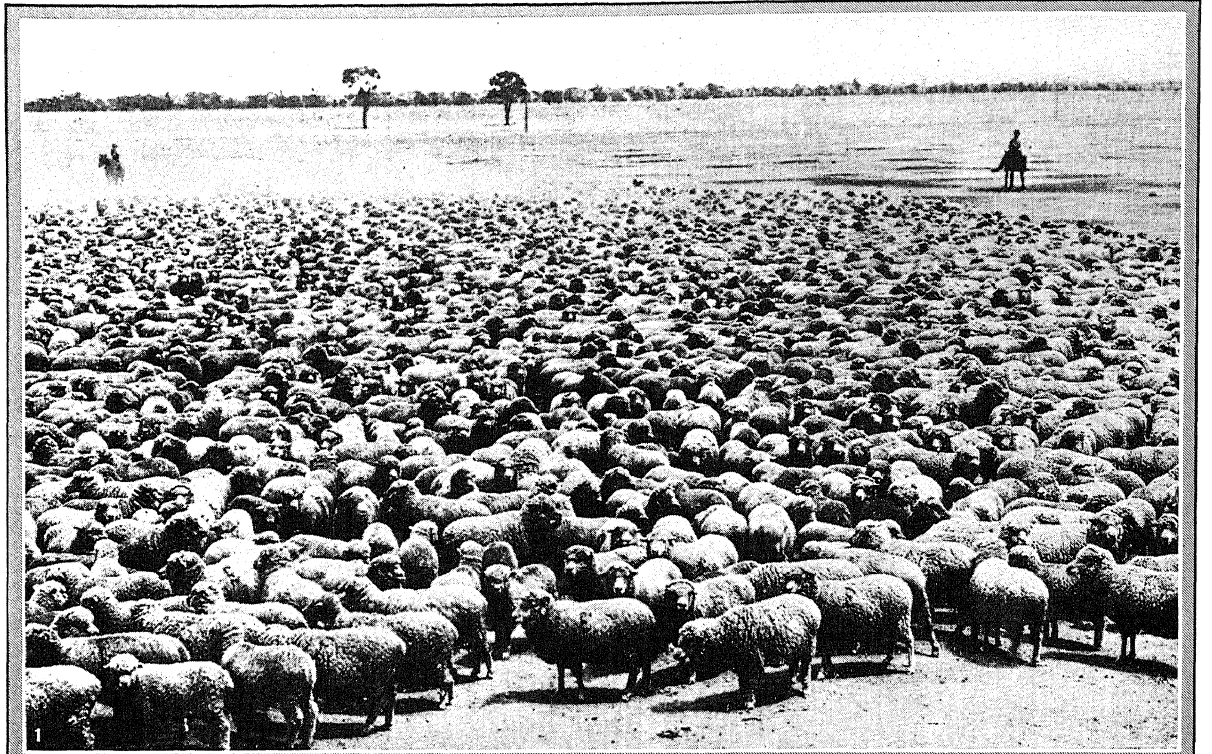
COURTESY COMMISSIONER GENERAL FOR AUSTRALIA, NEW YORK CITY

## MODERN BUILDINGS AND INDUSTRIES OF AUSTRALIA

1. Princes Bridge, Melbourne, Victoria.
2. Parliament House, Canberra, the Federal capital.
3. Darling Harbor coaling wharves, New South Wales.
4. Smelters, Point Pirie, South Australia.



## AUSTRALIA



COURTESY OF AUSTRALIAN NATIONAL TRAVEL ASSN.

### SHEEP RANCHING IN AUSTRALIA

1. Mustering animals for shearing on a sheep station in New South Wales. 2. "On the board" of a shearing shed in the Riverina District of New South Wales. The sheep are sheared by power-driven clippers.

# AUSTRALIA

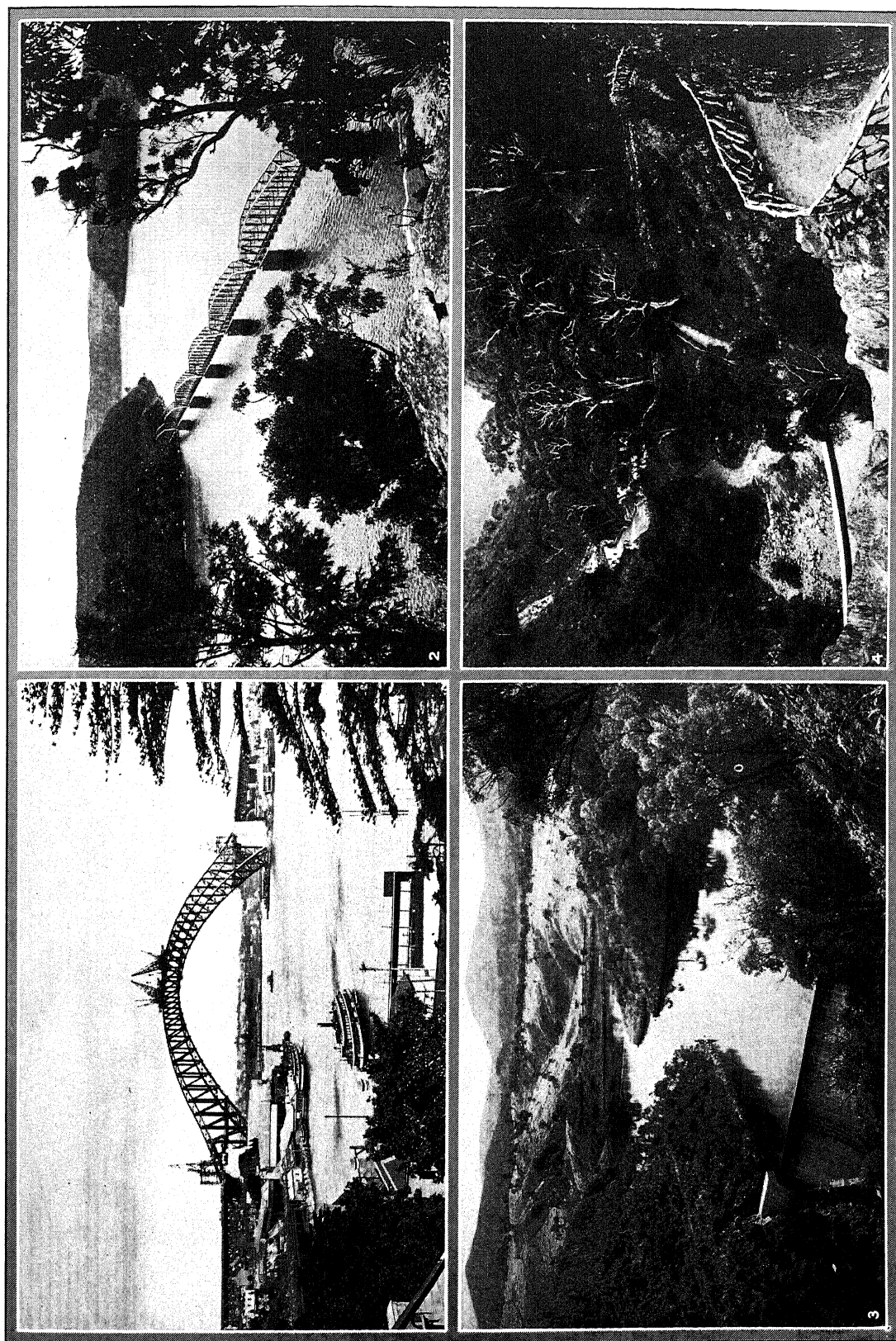


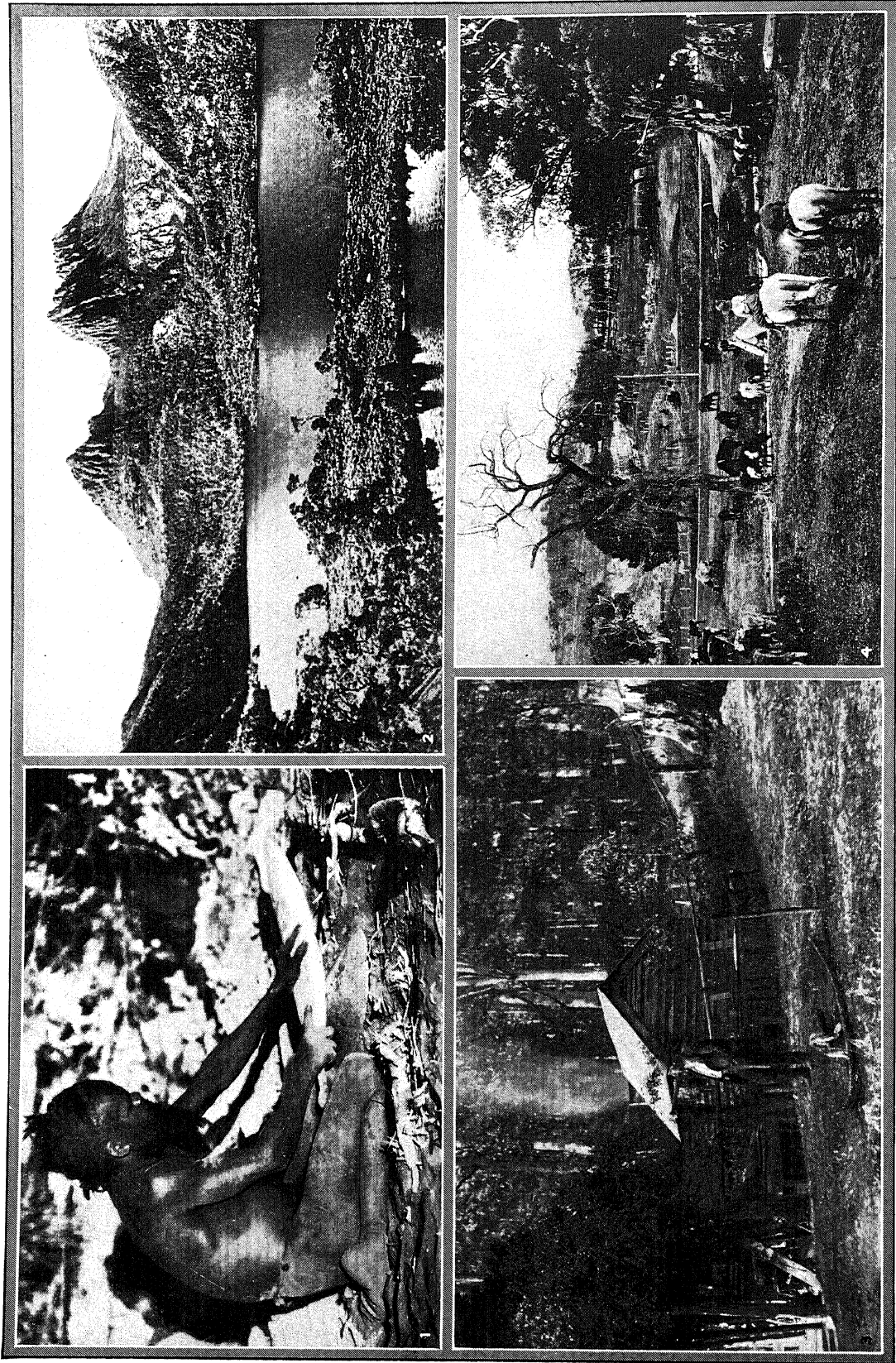
FIG. 1. COURTESY AUSTRALIAN NATIONAL TOURIST ASSOCIATION: 2, 3, 4, COMMISSIONER GENERAL FOR AUSTRALIA, NEW YORK

## THE SCENERY OF BEAUTIFUL AUSTRALIA

1. Single span arch bridge at Sydney, 1,650 ft. long, opened in March 1932.
2. Along the beautiful Hawkesbury River, New South Wales.
3. Water shed and spillway near Canberra, capital of the Commonwealth.
4. Waterfall Gully, a government recreational park in South Australia.



# AUSTRALIA



1, COURTESY AUSTRALIAN NATIONAL TOURIST ASSN.; 2, 3, 4, COMMISSIONER GENERAL FOR AUSTRALIA, NEW YORK CITY

## SCENES IN RURAL AUSTRALIA AND TASMANIA

1. Central Australian native making fire by friction, rubbing woamera, or throwing stick, on shield. 2. Cradle Mountain, Tasmania.
3. Settler's hut, Warburton, Victoria. 4. Scene in the Mt. Lofly Ranges, South Australia.



AUSTRALIA

Ar. 2,974,581 sq. mi.  
Pop. .... 6,438,999

PRINCIPAL  
CITIES

(Including Figures  
from Latest Popu-  
lation Estimates)

Pop.—Thousands

- 4 Adamstown N 23
- 324 Adelaide O 15
- 4 Albany O 6
- 8 Albury P 20
- 5 Ararat P 18
- 6 Armidale M 22
- 8 Bairnsdale Q 20
- 42 Ballarat P 18
- 9 Bathurst O 21
- 34 Bendigo P 18
- 17 Bridgetown O 5
- 21 Brighton Q 19
- 313 Brisbane K 24
- 23 Broken Hill M 18
- 5 Bunbury N 4
- 11 Bundaberg J 23
- 9 Cairns D 20
- 5 Camperdown Q 17
- 8 Canberra P 20
- 7 Castlemaine P 19
- 9 Charters Towers F 20
- 4 Cowra O 20
- 4 Croydon E 18
- 20 Dalhousie J 15
- 4 Darlington Point O 20
- 5 Dubbo N 20
- 5 Eaglehawk P 19
- 4 Echuca P 18
- 5 Forbes N 20
- 18 Fremantle N 14
- 43 Geelong Q 18
- 4 Geraldton E 21
- 5 Glen Innes L 22
- 12 Goulburn O 21
- 6 Grafton M 24
- 4 Gunnedah M 21
- 9 Gympie J 23
- 5 Hamilton Q 17
- 4 Horsham P 18
- 4 Inverell L 22
- 26 Ipswich K 23
- 4 Junee O 20
- 4 Kalgoorlie M 7
- 4 Kempsey M 23
- 24 Leichhardt Bar C 14
- 9 Lismore L 24
- 17 Lithgow N 22
- 7 Mackay G 22
- 13 Maitland N 22
- 12 Maryborough J 24
- 1015 Melbourne Q 19
- 6 Mildura O 17
- 4 Mount Gambier Q 16
- 7 Mount Morgan I 22
- 3 Mudgee N 22
- 103 Newcastle N 22
- 5 Northam M 5
- 8 Orange N 21
- 26 Paddington N 19
- 4 Parkes N 20
- 17 Parramatta O 21
- 205 Perth N 4
- 3 Petersburg N 16
- 10 Port Pirie N 15
- 3 Quirindi M 22
- 30 Rockhampton H 23
- 12 Rockingham N 4
- 4 Roma J 21
- 5 St. Arnaud P 18
- 4 Sale Q 20
- 6 Sandgate K 24
- 3 Singleton N 22
- 5 Southport L 24
- 5 Stawell P 17
- 1239 Sydney O 22
- 7 Tamworth M 22
- 3 Temora O 20
- 3 Tenterfield L 23
- 26 Toowoomba K 23
- 32 Townsville P 20
- 34 Unley O 16
- 8 Wagga Wagga O 20
- 8 Warrnambool Q 17
- 7 Warwick K 23
- 4 Wellington N 21
- 8 Wollongong O 22
- 3 Wyalong N 20
- 3 Young O 21

RAND McNALLY  
POPULAR MAP OF  
AUSTRALIA

SCALE 1:15,206,000  
1 Inch = 240 Statute Miles  
1 Centimeter = 152 Kilometers

Statute Miles  
Kilometers  
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described as hot and dry, and, on the whole, exceedingly healthy. There are 1,149,320 sq. mi. of Queensland, Western Australia and the Northern Territory in the tropics, and 1,825,261 sq. mi. in the other states are within the temperate zone. In the interior the summer temperature occasionally reaches 120° F. in the shade. In winter the major portion of the country south of the tropical zone is subject to ground frosts. The hottest area of the continent is in the northern part of Western Australia. In the region of the Australian Alps the temperature seldom, if ever, reaches 100° F. even in the hottest summer. Tasmania has a moderate and uniform range of temperature throughout the year.

In the tropical portions the rains occur in the summer, but in the temperate districts they are almost wholly confined to the winter months. The greatest quantity of rain falls on the east coast, being 50 in. at Sydney, diminishing considerably inland, so that at Bathurst, 96 mi. from the sea, it is only 23 in. and at Wentworth, 476 mi., 14 in. In the south, at Melbourne and Adelaide, the rain is about 25 and 20 in.; in the coastal districts of Western Australia about 30 in.; in Queensland from 40 to 70 in. on the coast, but much less at a moderate distance inland. From Rockingham Bay northwards the rains are tropical. Some inland districts of South Australia and Western Australia have an annual rainfall which rarely exceeds 10 in. and periods of drought sometimes occur in all the central areas. The west coast of Tasmania usually has summer rains.

**Flora.** The plant life of Australia comprises one of the richest, oldest and most peculiar of continental floras, although, because of very extensive arid areas, the total mass of vegetation is relatively small. Of upward of 12,000 known species, more than one-half are found only in Australia. The flora consists of two sharply defined types: 1. the vegetation of the humid east and north coasts, which is distinctly tropical, containing palms, screw-pines, bamboos, tree-ferns and orchids; 2. the vegetation of the interior regions and of the south and west coasts, which is characteristically desert-like.

It is in the drier subtropical regions that the most unusual forms are found, as, for example, *Eucalyptus*, with about 200 species peculiar to Australia, ranging in size from small shrubs to lofty trees, sometimes 325 ft. in height. Among numerous other noteworthy trees are the acacias embracing some 250 endemic species, silk-oaks, beefwood, flame-tree, bottle-tree, huon pine and cypress pine.

Shrubs and dwarf trees occur in immense variety, notably the proteads (*Proteaceae*), about 600 species, and the tree-heaths (*Epacridaceae*), fully 300 species. On the interior plateaus these comprise the most typical of Australian plant formations, known as the scrub or mallé, somewhat resembling CHAPARRAL. While not forming forests of large extent, many native Australian trees yield valuable timber, as the jarrah, karri, bluegum, and various acacias (wattles) and araucarias. The greater part of the coast region

and extensive areas in the interior are covered with grasses, of which some 300 species are indigenous, affording pasture and forage.

**Fauna.** The animal life of Australia, like the vegetation, exhibits marked peculiarities. These are displayed to the most extreme degree among the mammals. With the exception of certain bats, a relatively small number of rodents, a single feral dog, and a few marine forms, all the indigenous mammals of the continent are marsupials and monotremes. There are no native horses, oxen, deer, antelope, sheep or goats, and no bears, wolves, or other true carnivores, moles, anteaters or monkeys. To a large extent kangaroos and other marsupials take the place of the more highly developed mammals of other regions. The native marsupials, of which there are upwards of 100 species, may be roughly grouped according to their feeding habits, as the grass-eaters, comprising the kangaroos and wallabies; the fruit-eaters, as the phalangers; the flesh-eaters, as the dasyures; the insect-eaters, including the bandicoots, and the root-eaters, as the wombats. All these are relatively small animals, the largest of the kangaroos usually not exceeding a weight of 200 lbs. Still more primitive and unusual are the duck-bill and echidna, both egg-laying mammals belonging to the monotremes.

The bird life of Australia ranks next to that of South America and tropical Asia in the number and beauty of its forms. The region is distinguished by having the apteryx, lyre-bird and emu, which are not found elsewhere, and also by many weaver-birds, bower-birds, brush-turkeys and honey-suckers. Parrots, including various handsome cockatoos and parakeets, are very abundant, and wild pigeons, many with exceedingly brilliant plumage, here attain their greatest development.

Snakes, most of which are venomous, skinks, geckoes and amphibians are numerous. Fresh-water fishes, which are very limited in variety, include the peculiar Australian lungfish or barramunda.

**Timber.** Although the major portion of the continent contains some woody vegetation, thick forest is confined to very narrow areas in southwest Western Australia, in the south and southeastern part of Victoria, southeastern New South Wales and a narrow fringe extending along the coast of New South Wales and Queensland. In some of the coastal forests there are trees of from 250 to 300 ft. in height. The greater portion of hardwood supplies are derived from the eucalyptus family. Away from the coastal belts the trees are more scattered and there are few of the dense forests which promote the growth of very tall straight timber. Few softwoods but a good range and variety of hardwoods occur. In Western Australia the jarrah and karri forests are found. Jarrah is exported to provide paving blocks for the streets of European cities. All Australia's trees are evergreen, but the eucalypts, of which there are over 230 species, shed a layer of bark annually. Large areas of forests have been destroyed to make way for the agriculturist. The farmer killed the trees by "ring-barking" and

burned the forests. Some pines are found in the Murray river districts. Wattles, the bark from which yields a good tanning agent, and acacias are widely distributed over the island. Softwoods are imported from Norway, Sweden and the United States. The terms "bush" and "scrub" are generally applied to land uncleared of the natural trees and bushes.

**Arid Area and Irrigation.** The center of Australia includes a large area which is practically desert, —approximately a third of the total area of the continent. This region is a moderately high table land. It is cut off by mountain ranges from the moisture-bearing winds which blow in from the sea. The desert area is practically unsettled and it cannot be developed agriculturally without extensive irrigation. The borders of this desert area are subject to prevailing droughts. To meet the threat of droughts as well as to advance agriculture in the desert area itself considerable work has been done in developing irrigation. In 1902 a particularly serious deficiency of water afflicted the whole of the eastern areas. No preparation by storing fodder or boring artesian wells to ward off the effects of the drought had been made, and so sheep flocks perished. The disaster drove many men to mixed farming on suitable soils worth the expense of irrigating.

It is only in recent years that the government of New South Wales has conserved the river waters, which when in flood were a source of damage. The Burrinjuck Dam on the Murrumbidgee River forms a vast artificial lake. The river channel carries the conserved waters for 200 mi. to an offtake which leads the water to a distributing canal, where it flows for 100 mi. through 750,000 acres of irrigable land. Over a large area in South Australia water pumped from the Murray can be supplied to fruit growers at the annual rate of 15 in. of water per acre. The people of Victoria have spent large sums on irrigation works in the northern lowlands, and in 1928 477,500 acres were under irrigated culture in Victoria.

There are more than 4,700 artesian and sub-artesian bores in Australia with a daily flowing yield of almost 500,000,000 gals. in 1928. Much of this boring has been done by private enterprise. The first private bore in the Australian artesian basin, an area which includes part of Queensland, New South Wales, Victoria, Western Australia, South Australia and Northern Territory, dates from 1879; the first government bore was completed in 1884. The maximum depth at which artesian water has been struck is 7,009 ft., the minimum 10 ft.

**Minerals.** It was the discovery of gold that first attracted population to Australia, but this metal appears to be a diminishing asset. The gold discoveries of 1851 totally altered the prospects of the country. The rush of gold-seekers put an end to the need for state-aided emigration and intruded a strong radical element into a society hitherto predominantly agricultural and conservative. An industrial interest was created which led to a very rapid growth of the prin-

cipal towns. Victoria was the state where the richest diggings were found. In 1892 the new and valuable gold fields discovered at Coolgardie brought an influx of population to Western Australia. Although the produce of the gold mines there has steadily decreased since it reached its highest peak in 1903, the development of agricultural resources has become very active. Gold is found in all the states except South Australia; half the total yield is obtained in Western Australia. Opals are found in western New South Wales and Queensland, and coal is mined in New South Wales, Victoria, Queensland, Tasmania and Western Australia, but is of greatest commercial value in New South Wales, where the fields cover an area of over 16,000 sq. mi. with an estimated supply of 115,000,000,000 tons. Half of the copper of Australia is produced in Queensland (Mount Morgan); New South Wales (Cobar) and Tasmania (Mount Lyell) supply the remainder. The Broken Hill district of western New South Wales has the most productive silver-lead mines on the continent.

**Agriculture.** Though Australia is still primarily a land of large proprietors, a rural democracy has been established by advances made to settlers by the government agricultural banks. The small holders do not as a rule possess their lots, but rent them from the state on long leases which are virtually equivalent to a recognition of proprietorship. Wheat is the most extensively grown crop in Australia, the area under cultivation for grain and hay amounting to nearly 70% of the total crop acreage of the country. In 1928 there were over 19,000,000 acres under crops. The average yield of wheat per acre for the ten seasons of 1918-28 was 12.2 bu. Wheat has been exported from Australia in considerable quantity since 1870, but in recent years the amount has fluctuated owing to the effects of drought and careless methods of cultivation. Since 1920 a new area of wheat land has been opened up in Western Australia, and skilled methods of cultivation have been introduced. Oats represent about 6% of the area under crops in Australia; the average yield per acre is about 15 bu., the highest being in Tasmania and lowest in South Australia. Maize, or corn, is grown extensively for grain in New South Wales and Queensland, and in all the states to a less extent for green forage in connection with the dairying industry. The area under barley in South Australia accounts for about 68% of the Australian acreage. Most of the barley grown is of the malting variety. Rice is cultivated in the irrigation area of New South Wales.

The hot and moist climate of the northern coast districts of Queensland is well-suited to the growth of sugar cane. The crop was introduced from the West Indies about 1860, and was grown on large plantations worked by natives of the Pacific Islands. The "White Australia" policy of keeping the continent for the white man led to the colored people, called Kanakas, being sent home. The plantations have been broken up into smaller holdings and the cane is cultivated by "growers" who own them or

hold them on long lease from the state. The industry has flourished in recent years.

Almost every known commercial species of fruit is grown in Australia. The state governments have established experimental orchards, staffed by experts. Apples, peaches, apricots, citrus fruits and grapes are extensively cultivated. The Australian climate with its abundant sunshine is particularly suited to the production of such dried fruits as raisins, currants and sultanas, but like the allied industry of fruit-growing, it was comparatively small until the planning of irrigation schemes and heavily subsidized soldier settlements after the World War. The vine was introduced into South Australia in its early years, but it was not until 1893 that wine-growing was seriously encouraged and an attempt was made to secure a fine-quality product. The introduction of skilled wine-growers from Europe and of better stocks has worked an improvement, and since 1920, by the grant of bounties from the state and of preferential duties in the British market, the industry has been greatly extended.

**Sheep.** The merino sheep is one of Australia's greatest sources of wealth. The Australian is a scientific stock-breeder and has done much in raising the standard of merino wool. The original sheep introduced into the country came from Bengal and South Africa. These had fleeces more like hair than wool, but when crossed in 1793 with English and Spanish merinos, successful results were obtained. The average fleece then weighed  $3\frac{1}{2}$  lbs. but recently the average yield from each sheep has been between  $6\frac{1}{2}$  and 8 lbs. The saltbush found in the dry areas of Australia is valuable to sheep as a fodder plant, and has been introduced into arid regions of the United States. The pastoral wealth of Australia and the nation's prosperity is largely dependent on its wool clip. Export of wool averages about 48% of the total annual shipments from the country and averages about \$350,000,000 in yearly export value. In recent years many stations, or ranches, have been breeding large cross-bred sheep for food supply. The production of mutton and lamb in 1928 was nearly 500,000,000 lbs., of which about 84% was consumed locally and 16% exported. This makes the average yearly consumption of mutton and lamb in Australia 67 lbs. per person, a quantity greatly in excess of the per capita consumption in the United States, Canada and Britain, which in the same year averaged  $5\frac{1}{2}$  lbs.,  $8\frac{1}{2}$  lbs. and 27 lbs. respectively.

**Manufacturing.** The products made for home consumption include flour, woollen textiles, leather, footwear and furniture. Principal exports are wool (Australia exports more wool than any other country), wheat, meat, butter, sugar, skins, hides and fruit. The imports are textiles, clothing and manufactured fibres, metal manufactures and machinery, paper and stationery, drugs, chemicals, fertilizers, rubber, rubber goods and jewelry.

**Education.** Primary education is free and compulsory throughout the continent. Control or super-

vision is vested in the various state governments; control is applied to the free state schools, supervision to those privately owned or conducted. Children remain at school until they are 14 years of age, or receive certificate of competency in primary education. The states provide free secondary education at high schools. The universities, which are supported by grants from the Commonwealth and state governments and by private benefactions, are located at Sydney, Melbourne, Brisbane, Adelaide, Perth and Hobart.

**Aborigines.** The aborigines of Australia are of a dark coffee-brown complexion, with black curly hair, of medium height and inferior muscular development. Although some authorities support the theories that they are Caucasian or African, the generally accepted theory is that they are an offshoot of the Dravidian stock which originally migrated from the Malay Archipelago to northern Australia. Constitutionally incapable of imitating the enterprise of the white man, they nevertheless are sometimes useful in discovering water and tracking prisoners in the bush. They perform feats of skill with boomerangs and other primitive weapons and tools. *See also RACES OF MANKIND: Other Groups.* H. A. A.

**Government.** The early governors of New South Wales were military autocrats, checked neither by council nor assembly. In 1823 a nominated Legislative Council was instituted, though its actual power was slight. In 1825 Van Diemen's Land (Tasmania) was separated from New South Wales. In South Australia and Western Australia councils were established to advise the governor, but with no elective members. Popular desire for participation in the government was recognized in 1842 by the provision for elective members of the councils in New South Wales and Van Diemen's Land, and in the notable Act of 1850 under which Victoria became a separate colony, the colonies were authorized to draft constitutions for themselves. New South Wales, Tasmania, South Australia and Victoria presently became self governing colonies, as did Queensland when it became a separate colony in 1859, and Western Australia in 1890.

Early attempts to secure a federal union of the colonies failed, but bitter tariff wars, the need for cooperation in economic development, the desire to consolidate public credit, fear of foreign aggression, and a developing national pride led to a series of conferences and conventions in the decade 1889-99, out of which evolved a federal constitution which was enacted, after ratification by the people of the several colonies, by the British Parliament, becoming operative on Jan. 1, 1901.

The constitution of the Commonwealth provides for a governor general appointed by the Crown, a federal Parliament composed of a senate of six members from each of the states, and a house of representatives elected from districts on a population basis. Actual executive power is vested in a ministry responsible to parliament; machinery for forcing a decision in case of deadlock between the two houses

is provided. Wide powers are granted to the Commonwealth, and though the rights of the states are guaranteed, their authority has declined. A high court modeled on the United States Supreme Court is established. The constitution may be amended by the people of the states and of the Commonwealth. The constitution combines many features of the constitutions of Great Britain and of the United States.

Under the federal constitution the Commonwealth has maintained a protective tariff, has effectively excluded colored labor, has built a railway connecting South Australia and Western Australia, has furthered irrigation projects, fostered agricultural, industrial and commercial development, built a federal capital at Canberra, and attempted a program of social and industrial betterment, though individual states have taken the lead in political, social and economic experimentation. The secret ballot was first employed in Victoria; plural voting was early and successfully attacked in Australia; South Australia, in 1894, was only a year behind New Zealand in extending suffrage to women. Elaborate labor codes and programs of arbitration and strike control have been tried with varying success; the influence of labor in politics has been great. Popular education has advanced, and the universities established in each of the capitals have gained steadily.

X.

#### HISTORY

The first of the Europeans to visit Australia seem to have been Portuguese, whose voyages in the sixteenth century gave them some knowledge of the eastern and northern coasts. They were followed closely by Spaniards and, in the 17th century, by Dutch explorers, the most famous of whom, Tasman, discovered Van Diemen's Land and New Zealand and was the first to circumnavigate the Australian continent. The French presently showed some interest, but with no important result. In 1769 a ship commanded by Captain JAMES COOK carried a group of astronomers and a botanist, Sir Joseph Banks, to the southern Pacific to make scientific observations. The accounts of Cook's voyages and Sir Joseph's enthusiastic accounts of Australia attracted attention and helped bring about settlement, which did not occur until the American Revolution put an end to the British practice of sending convicts to the American colonies.

In 1787, since England was not yet ready to abandon transportation, the government of Pitt sent an expedition, including 717 convicts, to found a prison settlement at Botany Bay. Under the energetic direction of the first governor, Captain Arthur Phillip, who promptly substituted Sydney for Botany Bay, the colony slowly took root; agriculture made slow progress, the population had to depend on supplies from outside, and trade was not yet possible. The number of transported convicts increased steadily, but free settlers came slowly, though they were augmented by prisoners freed at the expiration of their terms.

By 1825 the exploration of the coast had been far advanced, the mountain barrier to the great plains west of Sydney had been pierced, the determined experimentation of John MacArthur had established wool-growing on a firm basis, and sealing, whaling and a few trading ventures had proved profitable. Van Diemen's Land, later Tasmania, was colonized with convicts in 1803; Queensland was similarly settled in 1824. A free settlement under private enterprise was made at the Swan River in Western Australia in 1829. In the years following 1832 a movement from Van Diemen's Land resulted in the relatively rapid settlement of Victoria, and the establishment of Melbourne in 1835. In 1836, as a result of the efforts of Wakefield and other proponents of systematic colonization, Adelaide was founded; South Australia was chartered as a separate colony and had the distinction of never being a penal settlement.

Humanitarian objections to transportation resulted in the restriction of convict shipments in 1840; Australian agitation brought an end to transportation to Van Diemen's Land in 1853, though convicts were sent to Western Australia until 1868. Free immigrants came in increasing numbers, drawn by the offer of cheap land, by the profits reaped from wool-growing, and in the gold rushes to New South Wales, Victoria and South Australia in the early 1850's. Nearly all came from the British Isles, though the gold rush attracted many from the United States and Europe, and a considerable colony of Germans came to South Australia.

The Commonwealth cooperated splendidly in the World War, but the effort drained resources and created problems which, in connection with world depression and the ambitious and expensive program of the Commonwealth government, has resulted in serious financial difficulties and in some challenging of federation. The Commonwealth is a member of the League of Nations and under the Treaty of Versailles was awarded a mandate over German New Guinea and other former German possessions in the western Pacific south of the equator. E. M. H.

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**AUSTRALIAN LANGUAGES**, a geographical rather than linguistic term for the aboriginal languages spoken in Australia, divided roughly into northern, central and southern, and comprising some 80 languages and dialects.

These are at present too imperfectly known to admit of accurate classification, and many are either extinct or moribund, so that it is not even certain whether

the entire group comes from a single source, or whether one is dealing here with several linguistic families. See also FAMILY, LINGUISTIC.

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**AUSTRALIAN LITERATURE.** Until 1819, when Barron Field published his *First Fruits of Australian Poetry*, Australia had no literature of her own. The people of this new country were mainly Englishmen sent there at first as convicts and later to develop the land. They were schooled in the traditions of English literature, they read English books, and it was quite natural that their early literary productions should be largely imitative of English models. Between 1819 and the 1860's little important work was done in the field of poetry; but the following years produced five of Australia's most gifted poets. Of these, the most forceful—despite an air imitative of Lord Byron—is Adam Lindsay Gordon (1833-70), an excellent writer of sporting and adventurous narrative poetry; his three volumes are *Sea Spray and Smoke Drift*, 1867, *Ashtaroth*, 1867, and *Bush Ballads*, 1870. Henry Clarence Kendall, who wrote vividly of the Australian country in *Songs and Poems*, 1862, *Leaves From an Australian Forest*, 1870, and *Songs From the Mountain*, 1880; Charles Harpur; George Gordon McCrae, author of *Mamba, an aboriginal reminiscence*, 1867; and Alfred Domett (1811-87), later the Premier of New Zealand, are the other noted poets of the period. Later poets worthy of note are George Essex Evans (1863-1909), author of *The Australian Symphony*; A. B. ("Banjo") Patterson, who wrote *The Man From Snowy River*, 1895; James Brunton Stephens (1835-1902), author of *Convict Once*; and Henry Lawson (1867-1922), also a writer of excellent short stories of bush life.

Fiction of Australian origin dates from the middle of the 19th century, with the publication of melodramatic novels having convict or bushranger heroes. Perhaps the most celebrated work of this period is *Geoffrey Hamlyn*, 1859, by Henry Kingsley, brother of the English novelist, Charles Kingsley. B. L. Farjeon's *Grif*, 1869, describes the night life in an Australian city; while Marcus Clarke (1846-81) published one of the last notable novels with a convict hero in *For the Term of his Natural Life*, 1870. More modern novelists include George Lewis ("Louis") Becke (1848-1913), noted for his *Adventures of a Super-Cargo*, 1906; Edward Barry, author of *'Neath Austral Skies*, 1909; Thomas A. Browne, better known as "Rolf Boldrewood" (1826-1915), who wrote *Robbery Under Arms*; Rose C. Praed (1851- ); Ada Cambridge (Mrs. C. F. Cross), author of *The Three Miss Kings*, 1891; and Mrs. Aeneas Gunn, author of *The Little Black Princess*; and "Henry Handel Richardson," whose *Fortunes of Richard Mahoney*, 1930, a trilogy, attracted considerable attention in America.

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**AUSTRASIA**, an ancient kingdom of the Franks with Metz as its capital. Verdun was on its western boundary. Historians called the domains of Theuderich I (511-534), and of his son and grandson, Austrasia, also the realm of Sigebert (561-575) and his son. Later the term applied to the kingdom which Dagobert inherited from his father Clotaire II and left in turn to his son, another Sigebert (634-639). Neustria, its rival, was on the west of Austrasia. These two kingdoms were united under Pepin the Short. After Charlemagne's death Austrasia was merged into Germany. It included what is now Belgium and Lorraine, extending as far as the Rhine.

**AUSTRIA**, a republic of Europe, bounded on the north by Germany and Czechoslovakia, on the south by Italy and Yugoslavia, on the west by Switzerland and on the east by Hungary; it comprises 32,369 sq. mi. Through the whole length of Austria run the Alps, which here attain an average height of 10,000 ft. In the north, the country is crossed by the Danube River, which descends from Germany.

Only a small percentage of the Austrian land is tillable, since the entire area is mountainous. The mountain slopes are devoted to stock raising, with occasional sections given to vineyards, orchards and gardens. The principal crops are rye, oats, potatoes, barley and wheat. The output of these products in 1928 in metric tons (2,204.6 lbs.) was: potatoes, 2,488,313; rye, 506,000; oats, 422,172; wheat, 351,549; barley, 281,986. Timber is also an important product. The number of animals in 1923 was: cows, 1,074,864; oxen, 302,103; horses, 282,651. Austria has a variety of minerals, chief of which are coal, iron, copper, zinc and lead. In 1928, the production of pig iron was 458,000 tons and of raw steel, 552,000 tons. The output of lignite in 1929 amounted to 3,524,792 tons. Of the industries, the manufacturing of motor cars, furniture, pianos and sport goods are the most outstanding. The making of cigars and cigarettes is also an extensive industry. Austria's commerce is mainly with the United States, Great Britain, Germany, Italy, Poland and Czechoslovakia. In 1929, the total value of the exports was 2,192,300,000 schillings (the schilling exchanged for about 14 cents in 1929) and of the imports 3,276,700,000 schillings.

Following the establishment of the republic in 1918, Austria faced repeated economic crises and was saved from financial ruin by timely foreign loans. The expenditures of the government consistently exceeded the revenue, and the state was overburdened with reparations and pre-war debts. In 1928, the total debts of the Austrian Republic were 2,363,692,276 schillings. The total national revenue in 1930 was 1,975,325,000 schillings, while the expenditures for the same year amounted to 2,128,959,000.

According to the census of 1923, the population of Austria was 6,534,481. VIENNA, the capital of the republic and its largest city, had, in 1929, an estimated population of 1,842,763. The population of other principal Austrian cities, according to the 1923 census, was: GRAZ, 152,706; LINZ, 102,081; INNSBRUCK, 56,401;

SALZBURG, 37,856; WIENER NEUSTADT, 36,956; SANKT POLTEN, 31,576 and KLAGENFURT, 27,423. More than 6,000,000 of Austria's people are Roman Catholics. Of the remainder, the Protestants and the Jews form the largest groups.

Education in Austria is compulsory for all children between the ages of six and 14, though there are special exemptions for children over 12. In 1927, there were 5,287 elementary schools with 710,397 pupils and 28,590 teachers. In addition to numerous secondary schools, commercial, technical and theological academies, there are three state universities, one at Vienna, one at Graz and one at Innsbruck. Many foreign students, especially from south European states, study at these universities. In 1927, the total enrollment in the three institutions was above 12,000, and the teaching staff numbered 1,350.

Austria is a federal republic composed of eight provinces and the city of Vienna. All provinces have their local assemblies. There is a federal legislative body in Vienna called the Nationalrat, the members of which are elected by the people at large for a term of four years. There is another chamber called the Bundesrat, which is chosen by the provincial assemblies and whose functions are purely advisory. The president of the Austrian Republic holds the executive power and is chosen by the people for a term of six years. He appoints the cabinet and has authority to dissolve the legislative body.

**AUSTRIA, HISTORY OF.** The geographic regions which comprise the present Republic of Austria came under Roman control during the reign of Augustus in the second decade of the Christian era, and were included in the Roman provinces of Noricum and Upper Pannonia. For centuries the Romans had to defend these areas against wandering Germanic tribes such as the Marcomanni, the Goths, and the Lombards. When the latter invaded northern Italy in 568, the lands between the River Enns and Dacia were occupied by the Turanian Avars, while the Slavs penetrated into Bohemia, Moravia, and Dalmatia.

**Medieval Times.** In 796 Charlemagne destroyed the power of the Avars, united and organized the territories between the Danube and Drave rivers into a margraviate, and called the area *Ostmark* or East March. The March was captured by the Magyars in 907, but retrieved for the Holy Roman Empire by Otto the Great through his victory over the Hungarians on the Lechfeld in 955. Otto II, in 976, gave the *Ostmark* to one of his followers, Leopold I, later called the first of the Babenbergers. In a decree issued by Otto III in 996, the East March was for the first time called "*Österreich*," this being later Latinized to Austria. Under successive Babenberg rulers Austria incorporated more and more of the surrounding territory until in 1156 it was raised to the dignity of a duchy. In 1192 the Duchy of Styria was united to that of Austria. The last of the Babenbergers, Frederick the Warlike (1230-46), also added part of the Duchy of Carniola to his patrimony.

From 1246 until 1282 there was a period of interregnum in Austria, largely as a result of conditions in the HOLY ROMAN EMPIRE. After several years of confusion following the death of Frederick, some Austrian nobles in 1251 invited Ottokar II of Bohemia (*see CZECHOSLOVAKIA, History*) to govern Austria. Ottokar accepted the invitation with alacrity. In 1260 he also took possession of Styria, and in 1269 he acquired Carinthia and part of Carniola. When, however, Rudolph of Habsburg became Emperor and King of the Germans in 1273, the former Babenberg duchies were declared to be lapsed fiefs of the Empire. Ottokar refused to recognize Rudolph as king, and war followed. Two campaigns were fought, in 1276 and in 1278, and in the latter year Ottokar was killed in battle. Rudolph thereupon gave Austria, Styria, and Carinthia to his sons Albert and Rudolph. The brothers allotted Carinthia to Albert's father-in-law, Count Meinhard of Tyrol, and then, by additional agreements of 1283, Albert came into sole possession of Austria, Styria, and Carniola.

The Habsburgs quickly increased the size of their Austrian possessions. As a result of a dearth of male heirs in the House of Meinhard, all of Carinthia was reunited with Austria in 1335. The Tyrol was acquired in 1363. In 1379 the brothers Albert III and Leopold III divided the Habsburg inheritance in such a way that the former got the Austrian duchy, and the latter secured all the rest. Leopold, who founded the Styrian Habsburg line, came into possession of Trieste in 1382 and also purchased some Swabian regions. With the death in 1457 of Ladislaus Posthumous, the Austrian Habsburgs died out, and all their lands accrued to the Styrian branch of the family. But not long thereafter, Bohemia and Hungary, which in 1437 had fallen to Albert V through marriage, were lost, as were also the Habsburg Helvetian ancestral possessions. Nevertheless the prestige of Austria was greatly increased when, under Emperor Frederick III (1440-93), it was officially raised to the rank of archduchy. From 1438 until the end of the Holy Roman Empire in 1806, moreover, the imperial crown was worn solely by Habsburgs or Habsburg-Lorrainers, except for a brief period of five years between 1740 and 1745.

In 1477 the future Maximilian I (1493-1519), by marrying Mary of Burgundy (1457-82), added another rich heritage to the Habsburg possessions, for Mary was the heir of the Burgundian Duke Charles the Bold. Maximilian's grandson and successor, Emperor Charles V (1519-56), who was also the grandson and successor of King Ferdinand the Catholic of Spain, fell heir to vast possessions in Europe, the Americas, and Asia. It was, in fact, impossible for him to control his far-flung territories and simultaneously to combat the perils of the Protestant Revolt and the Turkish onslaughts. Accordingly, in 1521-22, Charles gave his German family lands, except the Netherlands, to his brother Ferdinand. The latter, in addition, in 1526 again acquired for the Habsburgs, through marriage, the kingdoms of Hungary and Bo-



hemia, including Moravia, Silesia, and the Lausitz. Most of the Hungarian lands, however, soon fell into the hands of the Turks. Upon the abdication of Charles V in 1556 Ferdinand secured the imperial title as well as the remaining Habsburg territories. When Ferdinand died in 1564, the family domains were once again divided. According to the wishes of their father, Ferdinand's three sons split up the inheritance as follows: Maximilian, in addition to becoming Emperor, got Austria, and Bohemia; Ferdinand got the Tyrol; and Karl got Styria, Carinthia, Carniola, and Gorizia. During the course of the next hundred years all sorts of territorial divisions and re-divisions between members of the family occurred. Not until 1665 were all the various areas again reunited, but thereafter, in accordance with a decree of Ferdinand II (1619-37), the rule of primogeniture was faithfully adhered to.

While the Habsburgs were successfully building up the power of Austria, they were not so fortunate in the imperial sphere. As emperors they constantly found themselves at odds with the German princes, the papacy, and the Italian cities. And so Austria's power was sometimes used for imperial aggrandizement, while the Empire, or at least part of the Empire, often was dragged into Austrian conflicts; and the Empire suffered the more by the arrangement. Within their personal domains the Habsburgs, in general, secured the good-will of the townspeople, protected and fostered commerce, founded universities, maintained a fair degree of order, and put up a much bolder anti-papal front than they did where the whole Empire was concerned. Despite this last circumstance the THIRTY YEARS' WAR—which was only the worst of a series of destructive conflicts involving religions, economics, political, and social maladjustments within Central Europe—had its immediate cause in the attempts of the Habsburg Emperor Ferdinand II, who had been educated by the Jesuits, to re-Catholicize those of his lands which had become Protestant.

Ferdinand was able, through the ample use of force, to reconvert Styria, Carinthia, and Carniola; but he faced serious rebellion in Bohemia and Hungary. Foreign complications inevitably arose and the Emperor soon was embroiled not only with his own rebels, but eventually with Denmark, Sweden, and France. The resulting thirty years of warfare pitched the Germanies into an economic and social morass from which they did not rise for a century and a half. In addition, Austria was deprived of a number of territorial possessions, including the Lausitz, and the Emperor's power was reduced practically to nullity. So weakened were the Central European regions by the struggle, that the Turks in 1683 were able to repeat an exploit of 1529 and besiege Vienna for the second time in 154 years. Only the timely appearance of a Polish army under King John Sobieski and a German army under Charles of Lorraine, saved the imperial city from capture. But this was the high point of the Turkish advance into

the Germanies, for Prince Eugene of Savoy soon defeated the sultan's forces so badly that the Sublime Porte was constrained to accept the Peace of Karlowitz, 1699, whereby the Habsburgs regained all their eastern losses and besides secured part of Slavonia and the region north of the Save River to the Banat of Temesvar. In 1718 Turkey also ceded Wallachia, part of northern Serbia, and a slice of Bosnia to Hungary. But these last acquisitions were lost again in 1739. Meanwhile Transylvania had been united with Hungary into a hereditary kingdom of the Habsburgs.

Less successful was the House of Austria in an attempt to make good a claim to the throne of Spain in the opening years of the eighteenth century. From 1701-13 there raged the WAR OF THE SPANISH SUCCESSION, with France as Austria's chief rival and opponent. A compromise settlement of the conflicting claims was signed at Utrecht (*see* UTRECHT, TREATY OF) in 1713 and confirmed at Rastatt in 1714. The Spanish crown went to a French prince, but Austria obtained the former Spanish possessions in the Netherlands, thereafter known as the Austrian Netherlands (substantially the present BELGIUM), and Milan, Mantua, Naples, and Sardinia.

**Period of Maria Theresa.** From 1711-40 Austria and the empire were ruled by Emperor Charles VI who, after the death of his only son, devoted a large portion of his diplomatic activities to ensuring the succession of his lands to his daughter Maria Theresa. To further his end Charles drew up a PRAGMATIC SANCTION in 1720 declaring the Habsburg heritage to be indivisible and designating Maria Theresa as his successor and heiress. He made a great many territorial and commercial concessions to most of the important European powers in order to secure their official recognition of the Sanction. Thus, he attempted to please the English by curtailing the activities of the Ostend Company, Austria's only East Indies company. Then, to satisfy Spain, he exchanged Sardinia for Sicily in 1720, and finally returned both Sicily and Naples to Spain in 1735. In 1737 he secured the favor of France by taking Tuscany in exchange for his son-in-law's domain, Lorraine, which was given to the father-in-law of Louis XV, Stanislaus Leszczynski. (*See* POLISH SUCCESSION, WAR OF THE.) Upon the death of Charles in 1740, therefore, Maria Theresa came into control of all the remaining Habsburg domains, though not, of course, of the imperial title.

When Maria Theresa actually succeeded to the Habsburg thrones, several of the powers, particularly Prussia and Bavaria, were unable to resist the temptation to add to their prestige and territorial expanse at Austria's cost. Remarking that a well-drilled army would have proved a much more useful legacy to Maria Theresa than all the paper guarantees which her father had left her, Frederick the Great of Prussia at once moved to occupy part of Silesia, Austria's richest German province. There followed a series of wars, all phases of the general WAR OF

THE AUSTRIAN SUCCESSION, 1740-48, as a result of which Prussia secured Silesia, the elector of Bavaria became Emperor Charles VII during 1742-45, and finally the husband of Maria Theresa, Francis of Lorraine became Emperor Francis I, 1745-65. In this war England sided with Austria, while France supported the Bavarian claims and so incidentally aided Frederick.

Naturally Maria Theresa was not easily reconciled to the loss of Silesia. When, therefore, through the statesmanly skill of Count Kaunitz, a complete diplomatic revolution was effected and France became friendly to Austria, the queen attempted, in what developed into the SEVEN YEARS' WAR, 1756-63, to recover the province. But Frederick, with the aid of a good army, great personal courage, and English money, successfully resisted this scheme. Upon the death of Emperor Francis, his son Joseph II became emperor, 1765-90, and co-ruler with Maria Theresa of the hereditary Habsburg lands until her death in 1780. In 1772 Austria joined with Prussia and Russia in the first partition of Poland, Austria's share of the spoils being Galicia.

Maria Theresa and Joseph II governed according to the best principles of enlightened despotism. The Queen was much beloved of her subjects, especially the Hungarians, but Joseph, by his arbitrary methods and impatience in bringing about advanced reforms, met with serious resistance in Hungary and in the Austrian Netherlands. Greatly disappointed and disillusioned, he was forced to rescind a number of his reform edicts. Both rulers strove to modernize and make uniform the legal and administrative systems of the realm; to increase the political power of the Catholic Church; to lighten the loads of the serfs and free peasants; to aid the development of commerce, industry, and town life; to foster German art, literature, and music; to distribute more evenly the burdens of taxation; to extend more generally the opportunities for education and to achieve foreign diplomatic victories.

**Napoleonic Wars.** Upon his death in 1790 Joseph was succeeded by his brother Leopold II who had gained prominence as the enlightened Duke of Tuscany. Unfortunately, Leopold lived only until 1792. He was followed by the kindly but weak Francis II as Holy Roman Emperor, 1792-1806, and as Austrian Emperor Francis I, 1804-35. To Francis fell the task of guiding Austria and the Empire through the French Revolutionary and Napoleonic periods.

Her leading position as a continental power, her attachment to the doctrines of divine-right monarchy and absolutism, her ownership of territories close to and along the French border, and the circumstance that Marie Antoinette, wife of King Louis XVI of France, was a sister of Joseph II and Leopold II and an aunt of Francis II, all predestined Austria to become one of the chief opponents of the revolutionary movement with its theories of "liberty, equality, fraternity," and its practical corollaries of imperialism and expansionism. From the time of the

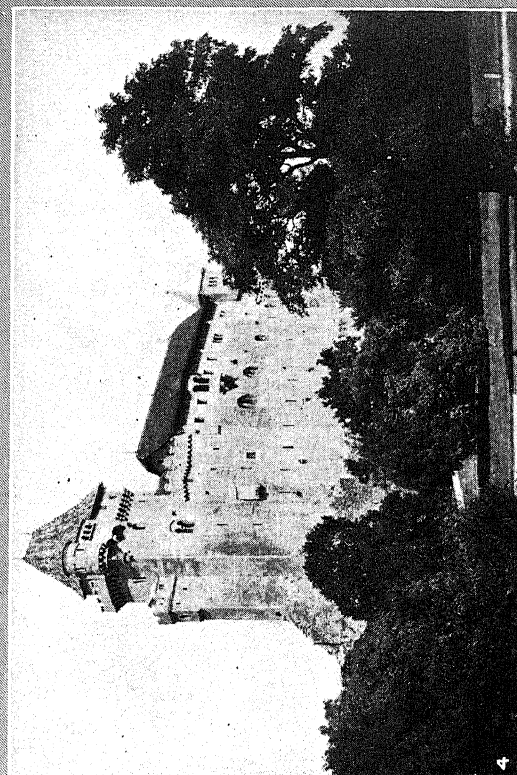
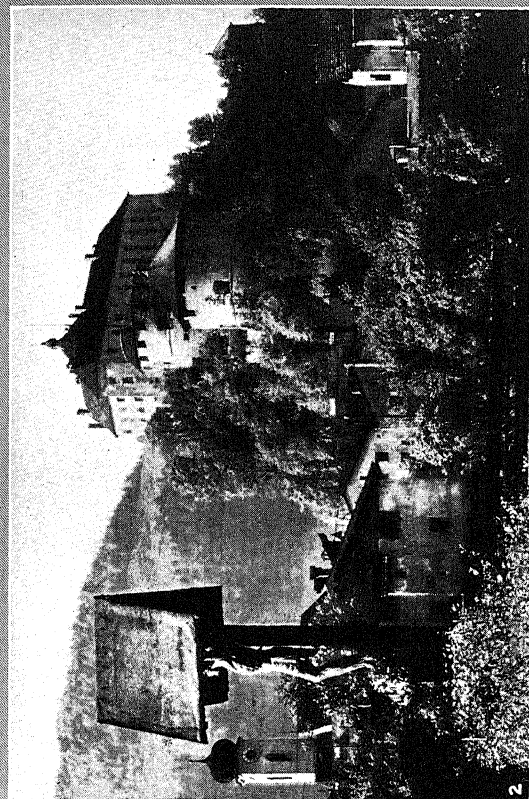
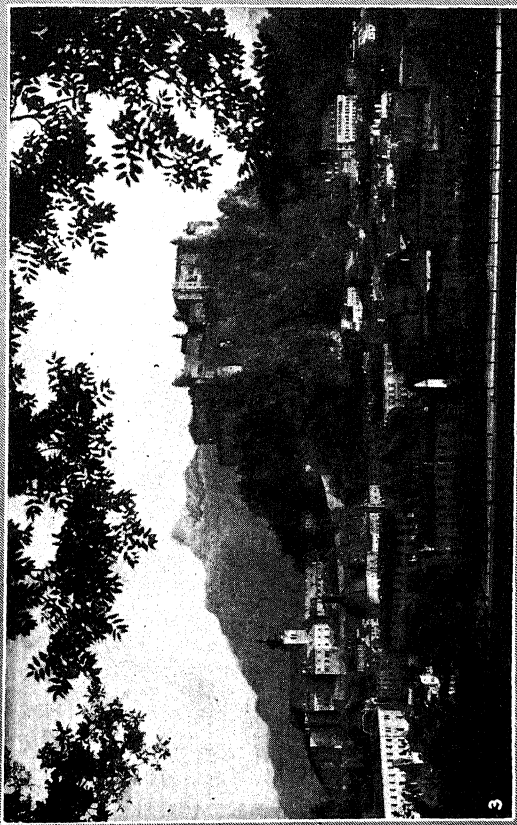
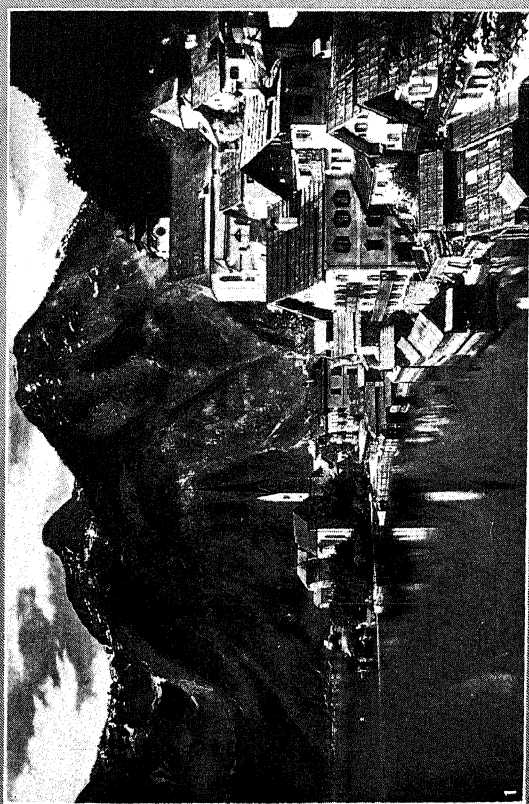
French declaration of war against Austria and Prussia in Apr. 1792, to the convening of the Congress of Vienna over a score of years later, Austria was exceeded in constancy and persistency as an antagonist of France only by England.

From 1793 to 1797 Austria was allied with Prussia, England, Spain, Holland, and Savoy in the First Coalition against France. After suffering a number of reverses in Italy at the hands of the young Napoleon, Austria signed the Peace of Campo Formio, 1797, whereby she ceded the Austrian Netherlands to France, recognized a reorganized northern Italy as a French protectorate, and received, in return, Venetia. In 1799, Austria, Russia, Great Britain, and some smaller states formed the Second Coalition, but again Austria was beaten in Italy and had to accept the Treaty of Lunéville, 1801, which confirmed the terms of the agreement of 1797. A Third Coalition was formed in 1805, consisting of Austria, England, Russia, and Sweden. Once more Napoleon was successful, at Ulm and Austerlitz, and Austria had to sign the Treaty of Pressburg, 1805, whereby she lost the Tyrol and Vorarlberg to Bavaria, Venetia to the Napoleonic Kingdom of Italy, and several counties and cities to Napoleon's lesser German allies.

Too stunned to join the Fourth Coalition, Austria now remained at peace for several years. But in 1809 she formed another coalition with England. This time, with her subjects stimulated to a high pitch of enthusiasm and inspired with some feeling of German nationalism, Austria won the battle of Aspern. But defeat came again, at Wagram, and the humiliating Treaty of Vienna or Schönbrunn followed. Austria now lost Galicia and much of her German territory. Her population was reduced by 3,500,000, and she had to pay a heavy war indemnity. Meanwhile, in 1804, Francis had changed his title from that of Archduke of Austria to Hereditary Emperor of Austria, and two years later, in view of Napoleon's action in reorganizing the Rhenish states into a confederation under his protection, Francis dissolved the Holy Roman Empire.

In 1810 Marie Louise, daughter of Emperor Francis, was married to Napoleon. Soon thereafter a political alliance between France and Austria was negotiated. The new Austrian chancellor, Count Metternich, who was largely responsible for the alliance, simultaneously schemed for the final downfall of Napoleon. The actual weakness of the pact became obvious when, after Napoleon's defeat in Russia in 1812, and his refusal of Metternich's offers of mediation in 1813 between France and the Sixth Coalition, Russia, Great Britain, Sweden, and Prussia, Austria joined the latter. On this occasion success attended the arms of the allies, and Napoleon was defeated at the BATTLE OF LEIPZIG. In 1814-15, then, Austria's prestige was further heightened when the congress which was to redraw the map of Europe met in Vienna. (*See VIENNA, CONGRESS OF.*) Francis nearly became bankrupt as a result of his expenses as host to the Congress, but Austria emerged from the gathering en-

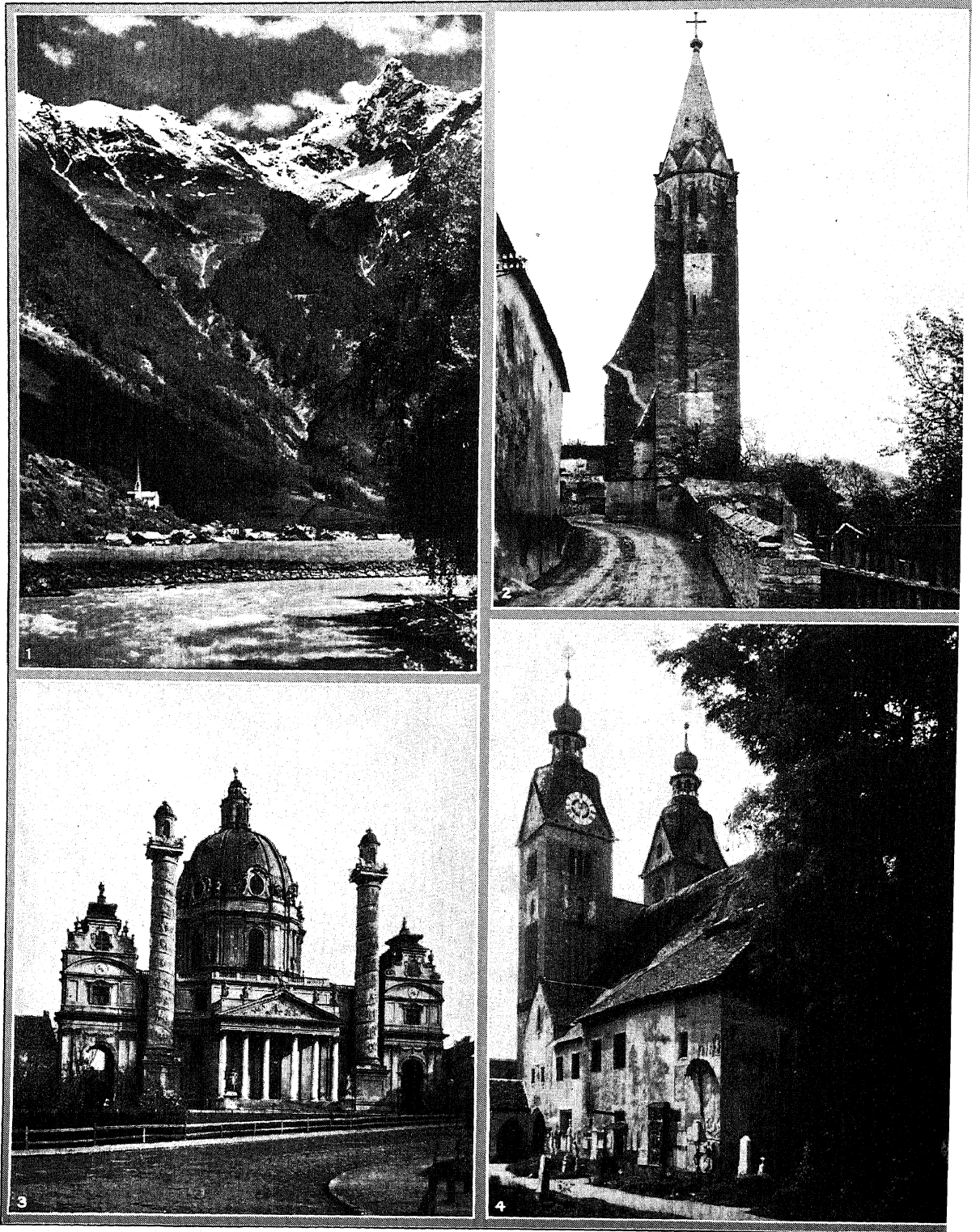
# AUSTRIA



## LAKES, CASTLES AND TOWNS IN THE AUSTRIAN ALPS

1. Lakeside view of Hallstatt, near Salzburg.
2. Ancient fortress of Geroldseck overlooking Kufstein in the Tyrol.
3. Salzburg with the ancient fortress of Hohen-Salzburg in background.
4. Restored castle of Liechtenstein, Nödling.

## AUSTRIA



1, 2, 4, COURTESY AUSTRIAN TOURIST OFFICE; 3, CONSULATE GENERAL OF AUSTRIA, NEW YORK

### AUSTRIAN MOUNTAINS, CITIES AND CHURCHES

1. Village of Otz at the foot of Mt. Acherkogel, 9,875 ft. 2. Schwallenbach on the Danube.  
3. Karlskirche (Charles Church), Vienna. 4. Maria Saal Church in Klagenfurt, capital of Carinthia.



## AUSTRIA

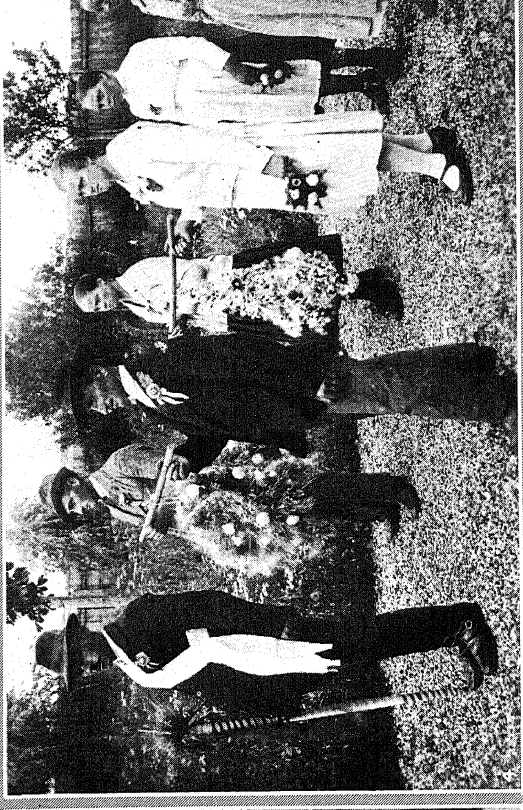
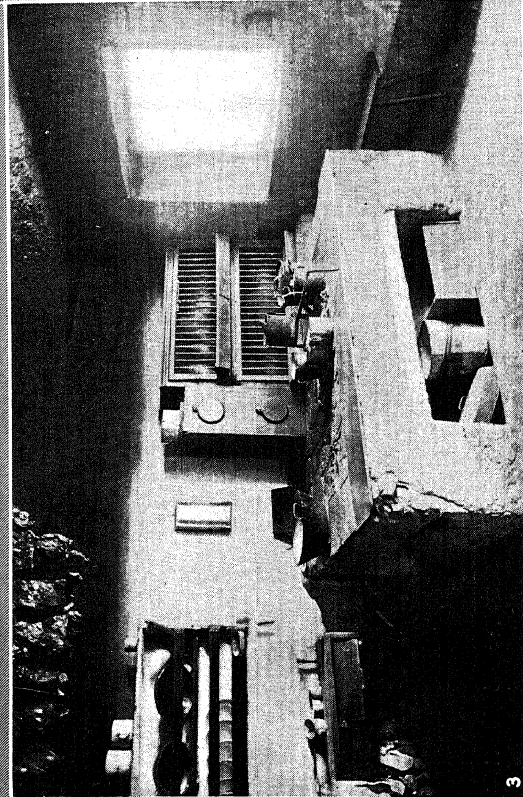
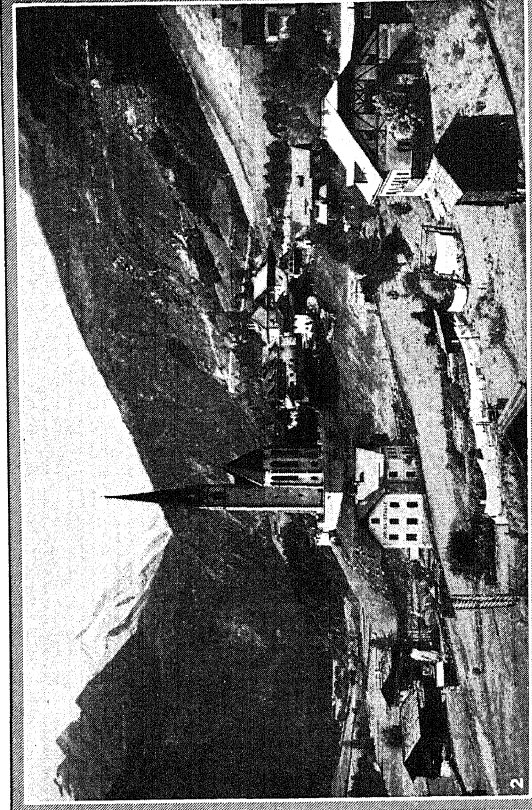


1. COURTESY CONSULATE GENERAL OF AUSTRIA, NEW YORK; 2. AUSTRIAN TOURIST OFFICE

### A ROYAL RESIDENCE AND A MODERN DWELLING IN VIENNA

1. Schönbrunn Castle, the former imperial summer residence of the Emperor, near Vienna.
2. Modern apartment house architecture as seen in Vienna.

# AUSTRIA



COURTESY OF AUSTRIAN TOURIST BUREAU; 1. COPYRIGHT OSTERREICHISCHE LICHTBILDSTELLE

## TYPICAL SCENES IN PICTURESQUE AUSTRIA

1. A mountain resort in the Semmering, not far from Vienna.
2. Heiligenblut, a village and tourist center in the Carinthian Alps.
3. A peasant kitchen in the Austrian Tyrol.
4. A wedding procession in Burgenland, southeastern Austria.



riched by the acquisition of Venetia in exchange for the distant Netherlands, the control over several duchies in northern Italy, the restoration of all her remaining territorial losses, and a dominant voice in the affairs of the new Germanic Confederation which replaced the old empire. The era of Napoleon, in fact, now was succeeded by the era of Metternich.

**19th Century.** The rising movements of democracy and nationalism following upon the revolutionary period were anathema to Metternich, who believed in a strong central government with paternalistic tendencies. Liberalism and nationalism, accordingly, were driven under cover so thoroughly, through the medium of such measures as the Carlsbad Decrees of 1819, that Austria remained practically untouched by the revolutions of 1830. But in 1848 the revolutionary fever struck her all the harder. The miserable condition of the serfs, governmental bankruptcy, reactionary legislation and oppressive censorship, military repression, and the crushing tax burdens caused riots in Vienna, Hungary, Bohemia, and Lombardy. Metternich was forced to flee for his life, and Emperor Ferdinand I, who had succeeded Francis in 1835, abdicated in favor of his 18-year-old nephew, Francis Joseph, 1848-1916. In 1849 the Magyars, led by the inspiring Louis Kossuth, set up an independent Hungarian republic, and in the same year Austria was granted a written constitution.

The Habsburgs then, however, had recourse to the age-old principle of *divide et impera*, "divide and rule," and used the various rising spirits of nationalism to stamp out the incipient liberal movements. One group of Austrian subjects was used against another so successfully that before the year 1849 was over peace and conservative rule were reestablished. In the process, a movement to unite Germany was foiled, the Italian states were resubjugated, with the aid of a Russian army Hungary was restored to joint rule with Austria, Bohemia was chastised, and the Austrian constitution was withdrawn. The net immediate gains of the revolution were the abolition of serfdom throughout all the Habsburgs' lands except Galicia, and the loss by the nobles of certain of their old privileges, notably exemption from taxation. Austrian dominance in the Germanic Confederation, however, was assured for some time longer.

Following the upheavals of 1848-49 there came a decade of peace during which the government concentrated its attention upon maintaining its hold over the smaller German states in the Confederation and checking the rising separatist spirits within the imperial domains. National finances were put upon a somewhat sounder basis than had hitherto been the case, and considerable activity was shown in the construction of railways and other internal improvements. The power of the Catholic Church, in particular its control over education, was increased by the Concordat of 1855. Then the attention of the authorities was again diverted to foreign matters through the hostile diplomacy of the Sardinian minister Count

Cavour. In 1859 the Austro-Sardinian War broke out. The Austrians were defeated by the French allies of Sardinia at Magenta and Solferino, and by the Treaty of Zurich, 1859, Lombardy was ceded to Sardinia.

The domestic repercussions of the military defeats were so strong that the several provincial diets were given wider powers of local self-government in 1860, and certain political concessions were made to the Magyars. In 1861 a formal constitution, providing for a bicameral legislature to represent the entire empire, was promulgated. The parliament was to sit at Vienna, and the first session was to open on May 1, 1861. However, Venetia, Hungary, Transylvania, and Croatia neglected to elect delegates, and the constitution finally was suspended. In addition to these domestic difficulties, in the early 60's, the Austrian authorities also found themselves unsuccessful in their attempts to wean away some of the north German states from the customs union with Prussia, and to get the Confederation Diet to adopt a new constitution calculated to strengthen Austria's grip on German affairs.

**Expulsion from Germany.** By this time Prussian politics had come into the control of Count Bismarck who bent his mighty energies to the task of unifying Germany and who had come to the conclusion that the process of unification must entail the ousting of Austria from German councils. Having made certain, with the aid of the King and such officials as Von Roon and Moltke, that Prussia was sufficiently prepared, Bismarck picked a quarrel with Austria in 1866 over the final disposition of the territories which the two powers had taken from Denmark in 1864. (*See SCHLESWIG-HOLSTEIN.*) Bismarck made Prussia appear as the aggrieved party in the struggle, but after the war, which lasted only some seven weeks (*see SEVEN WEEKS' WAR*), he treated Austria quite leniently in the Peace of Prague. To Italy, which had joined Prussia in the war, Austria was made to cede Venetia. In addition, Austria withdrew from German affairs; recognized the territorial annexations which Prussia made from among the smaller states which had aided Francis Joseph; and agreed in advance to any arrangement which might be made under Prussian leadership for the future regulation of German relations.

In order to retain the loyalty of the Hungarians during the war, moreover, Austria in 1867 agreed to a dual governmental system as proposed by the practical Magyar leader, Francis Deak. Austria and Hungary were separated, the former remaining an empire, the latter, including Croatia-Slavonia and Transylvania, becoming an independent kingdom. The two lands henceforth were to be united merely in a personal union through a common ruler, and through joint ministries of foreign affairs, war, and finance. These ministries were to be controlled by groups of delegates chosen by the two separate parliaments. Ten-year treaty agreements were to be entered into between the two halves of this Dual

Monarchy to deal with the problems of tariff schedules, trade, the public debt, and railways. See *AUSGLEICH*; *AUSTRIA-HUNGARY*.

**The Dual Monarchy.** Austrian relations with the Hungarian half of the dual monarchy were far from harmonious and there were quarrels every time the ten-year treaties were renewed. Moreover, because the Magyars were more powerful in Hungary than the Germans were in Austria, the former came to exercise an increasing and not always beneficial influence in imperial-royal affairs. From an economic point of view, however, the dual arrangement was fairly satisfactory, for Austria was predominantly industrial and Hungary agricultural. Now, too, Austrian foreign policies were focussed more toward the southeast than toward Germany or Italy, and an increasing interest was shown in Balkan matters. Thus, in 1878 Austria-Hungary was permitted by the Congress of Berlin to occupy and administer the Slavic provinces of Bosnia and Herzegovina, and in 1908 these regions were annexed outright. The Slavic element in the monarchy thereby became so important that increased impetus was given to a movement for converting the dual into a triple monarchy, with a Slavic kingdom to parallel the German and Magyar states. The Austrians, on the whole, were more favorably inclined to accept such an arrangement than were the Magyars, and Archduke Francis Ferdinand was perhaps the leading exponent of the idea. In the end it was the Balkan orientation of Austro-Hungarian foreign policy which led to conflicts with Russia, Italy, and Serbia, and which eventually became one of the factors leading to the World War in 1914.

Ousted from Germany, and with lessened Italian interests, Austria, from the time of the late 60's, was the better able to concentrate on her domestic problems. Under a series of constitutional laws of 1867 the Austrian half of the Dual Monarchy was given a bicameral legislature or *Reichsrat* consisting of a House of Lords, *Herrenhaus*, and a House of Representatives, *Abgeordnetenhaus*. The Lords consisted of hereditary nobles, ecclesiastical officials, and peers named by the Emperor. The Representatives were elected, at first by a restricted group of voters, but after 1907 on a basis of compulsory, universal, manhood suffrage. The consent of both houses was required for the passage of laws, and the ministry was made responsible to the legislature. The Austrian political parties were largely national in character, chiefly German, Czech, and Polish, but there were also three main doctrinal divisions: the Liberals, that is, the middle class group favoring aids to industry and opposing the influence of the Catholic Church; the Christian Socialists, that is, the Catholic party, led for a long time by the able Karl Lueger; and the Social Democrats, organized in 1888, and increasingly important as industrial conditions became worse. A fair amount of social legislation, however, was enacted, chiefly through the influence of the Christian and the Marxian Socialists.

The chief problem in pre-World War Austria was the nationalities question. Germans, Czechs, Poles, Ruthenians, Slovenes, and Italians were constantly at odds, and much legislation was obstructed by national disputes. Disorderly scenes in the Austrian parliament were notorious for their frequency and vehemence. So serious were the racial difficulties that it was generally felt that a big war or the death of the aged Emperor-King Francis Joseph might well lead to a break-up not only of the dual monarchy, but of each of the halves of the monarchy as well. That these fears were justified became apparent during the World War which broke out on July 28, 1914, following the assassination of Archduke Francis Ferdinand one month previously in Bosnia by Serbian sympathizers. See *WORLD WAR*.

**World War.** During the war Austria and Hungary constantly quarreled over their respective military contributions and the distribution of food supplies. The various subject nationalities, moreover, though generally loyal at the outset, soon sensed the opportunity for liberation and before long did all they could to increase the difficulties of the authorities. Stern and autocratic measures were resorted to by the war government and, foolishly enough, concessions to national feelings and to democratic sentiment were withheld until it was too late for compromise. The death of Francis Joseph, Nov. 21, 1916, and the accession of his well-meaning but inexperienced grandnephew, Charles I, 1916-18, hardly improved the situation which, simultaneously, was becoming increasingly bad from a military point of view. Allied propaganda found fertile soil, and Austria after a time found it impossible to send enough men to the Russian, Balkan, and Italian fronts.

Charles's desperate attempt to retain a hold over his monarchy by the issuance of a manifesto, Oct. 16, 1918, for the creation of an Austrian federated state with local autonomy for the provinces was useless, and after further defeats Austria signed an armistice with Italy on Nov. 2. Charles abdicated his imperial throne on Nov. 11 and eventually went to Switzerland. A provisional government consisting of Social Democrats and Christian Socialists was set up in Vienna. On Nov. 12 this government promulgated a constitution declaring German Austria to be a republic and an integral part of the three-day-old German Republic. A new flag was adopted, and under the leadership of such men as Otto Bauer, Karl Seitz, Karl Renner, and Ignace Seipel the provisional government carried on until Feb. 1919. Then it gave way to a Constituent Assembly which sat until Oct. 1920, and which accepted the peace treaty of St. Germain, signed Sept. 10, 1919. Since the Allies meanwhile had vetoed the Austrian union with Germany, the Assembly naturally had to draft a constitution for an independent Austrian republic. From Dec. 1921, the Republic of Austria comprised nine *Länder* or provinces: Burgenland, Carinthia, Lower Austria, Upper Austria, Salzburg, Styria, Tyrol, Vorarlberg, and Vienna.

**Post-War Conditions.** Economic and social conditions after the war were shocking, especially in Vienna where employment was scarce and food was scarcer. Thousands of starving children were sent to Scandinavia to be fed. The death rate mounted with an alarming rapidity. But a constitution finally was adopted, providing for a federal system with a bicameral legislature and for universal suffrage for adults over twenty. The two houses sitting together were to comprise the Federal Assembly, with power to elect the president for four years by secret ballot. In Dec. 1920, Dr. MICHAEL HAINISCH was elected president, and in the same month Austria was admitted into the League of Nations. In Dec. 1924, Dr. Hainisch was reelected for another term of four years.

From 1921 to 1932 Austria struggled along under various ministries. Foreign financial aid was constantly required and for a time the League of Nations supervised the republic's monetary affairs. It appeared almost impossible to save Austria from the economic plight and maladjustments into which the "Balkanization," or cutting up of Central Europe, had plunged her. From having been the heart of a great empire, Austria now was cast adrift, economically unbalanced and with a population of less than seven millions. The tragedy was made worse by the quarrels which ensued between the Socialists, particularly in Vienna, and the agrarian, conservative Clericals of the remainder of the land. The Socialists organized a *Schutzbund* and the agrarians a *Heimwehr*, and armed clashes between the rival organizations were frequent. Naturally such occurrences made it ever more difficult to secure the much-needed foreign credits. Chancellor Johann Schober had more success than any of his colleagues in dealing with these "private armies," but he never remained in power for long, consecutive periods. In Dec. 1928, Dr. Wilhelm Miklas was elected president to succeed Dr. Hainisch, since the constitution permitted only two terms in office.

In foreign affairs the new Austria had two chief interests: the fate of the 250,000-300,000 Germans in the South Tyrol which had been awarded to Italy after the war, and the question of *Anschluss*, or union with Germany. The former question loomed large until 1928, when Mussolini finally threatened "action" if Austria did not cease to "interfere" in "Italian" affairs. But *Anschluss*, which came ever more to be regarded as vital for the continued life of Austria, was by far the more important issue. Although not all Germans were anxious to incorporate Austria in the Reich, and although not all Austrians were anxious to have their state swallowed up in the larger republic, the prevailing sentiment on both sides favored amalgamation—for economic, nationalistic, and strategic reasons. For similar reasons, moreover, France, Italy, and the Little Entente were anxious to prevent *Anschluss*. A climax in the matter was reached in Mar. 1931, when a customs union between Germany and Austria was announced. Bitter foreign opposition developed toward this scheme,

which was called a thinly veiled *Anschluss*, and France and the Little Entente brought financial and diplomatic pressure to bear to force the issue before the Permanent Court of International Justice. The question to be decided was whether Austria, by coming to such an agreement, was violating those terms of the Treaty of St. Germain and of the financial convention of 1922, which forbade her to enter into any engagement which might alienate her political independence. By a vote of 8 to 7 the court ruled against the legality of the customs union. There were loud rumors that the decision was political rather than juridical, but it was accepted by all parties.

The condition of Austria during the world-wide depression after 1930 was more pitiable than ever. Even the staunchest of patriots began to wonder if there were any truth in the old saying: *Austria erit in orbe ultima*—"Austria will endure on earth forever."  
W. C. L.

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**AUSTRIA-HUNGARY**, often referred to as the Dual Monarchy, the Danubian Monarchy, or the Polyglot State, was the name of the political organism which came into being in 1867 as a result of a compromise, or *Ausgleich*, between the Habsburg Emperor and the Magyar patriots led by FRANCIS DEAK. The Dual Monarchy was ruled from the time of its organization until 1916 by the Emperor-King FRANCIS JOSEPH I, and from 1916 until its dissolution in 1918 by his grandnephew, CHARLES I.

The Habsburgs had acquired the territories comprising the Austrian part of the monarchy at various times beginning with 1278, had become hereditary kings of Hungary through marriage in 1526, and had assumed the title Hereditary Emperors of Austria in 1804. (*See GERMANY, History.*) An arrangement whereby all Austro-Hungarian possessions were ruled jointly by a Habsburg Government caused much discontent, particularly in Hungary, and during the years 1848-49 the Magyars revolted and proclaimed an independent republic, Apr. 1849. With Russian aid, however, Emperor Francis Joseph soon reduced the republic to submission, and Hungary once more came to be ruled jointly with Austria. In 1860 Francis Joseph was constrained to grant a constitution which provided for a bicameral Parliament (*Reichsrat*), representing the entire Habsburg patrimony and

sitting at Vienna. The various provinces were permitted to retain their local diets, and these diets were given the right to elect delegates to a House of Representatives. When Venetia, Transylvania, Hungary and Croatia refused to send delegates to the first Parliament, the constitution was suspended.

**Union of Austria and Hungary.** The Magyars, led by the practical and able Francis Deak, demanded a dual system of government whereby Austria and Hungary would become independent entities united only through the person of a common ruler and through common ministries of foreign affairs, war and finance. The defeat in the SEVEN WEEKS' WAR at the hands of Prussia and the break-up of the German confederation made Francis Joseph amenable to the wishes of the Magyars and in Feb. 1867, the *Ausgleich* was arrived at. By the terms of this compromise and some supplementary decrees of 1868, Francis Joseph was to remain Emperor of Austria and was in addition to be crowned as King of Hungary at Budapest. The empire of Austria was to include Lower Austria, Upper Austria, Bohemia, Galicia, Dalmatia, Moravia, Istria, Salzburg, Styria, Carinthia, Carniola, Bukovina, the Tyrol, Vorarlberg, and the city of Trieste. Hungary was to embrace the remaining Habsburg possessions including Croatia-Slavonia and Transylvania. The Emperor was to appoint the joint ministry of foreign affairs, war and finance. The work of this ministry was to be under the supervision of a joint Parliament known as the Delegations and sitting alternately at Vienna and Budapest. These Delegations were to be elected annually and were to consist of 60 members chosen by the Austrian Parliament and 60 chosen by the Hungarian Parliament. In every case the Austrian and Hungarian members were to meet in separate chambers and communicate in writing. Only in the event that three exchanges of written communications failed to bring agreement, were the two groups to meet together, and then merely for purposes of voting, not debating. Ten-year arrangements, moreover, were to be entered into between the two states on matters pertaining to tariffs, trade, the public debt, and railways.

This compromise was not wholly satisfactory, and there were unseemly quarrels whenever the 10-year treaties had to be renewed. The Hungarian delegates were usually able to present a more solid front than the Austrian delegations, since the former were almost entirely composed of Magyars, while the latter included enough non-Germans to make a united stand almost impossible. As a result the Magyars came to exert an undue and not always beneficial influence upon the foreign affairs of the monarchy. From an economic point of view the union was highly desirable, since industrial Austria and agrarian Hungary formed a relatively self-sufficient economic and geographic unit.

The nationalities problem remained as the chief bugbear of Austria-Hungary. According to the census of 1910 the 51,300,000 inhabitants fell into the following main national groups: 12,000,000 Germans; 10,

000,000 Magyars; 3,250,000 Rumanians; 750,000 Italians; 17,500,000 Northslavs, including Czechs, Slovaks, Moravians and Poles, and 6,750,000 Southslavs, including Serbs, Croats and Slovenes. There were constant racial quarrels, and eventually some momentum was achieved by a movement for the creation of a Slavic kingdom in addition to the Austrian and Hungarian states. The nationalities question also served greatly to complicate foreign affairs, especially the relations with Italy, with Russia, and in the Balkans. Thus the annexation by Austria-Hungary of the provinces of Bosnia and Herzegovina, 1908, which provinces she had been permitted merely to occupy by the CONGRESS OF BERLIN, 1878, caused one of the most serious of the many pre-World War crises. (See WORLD WAR.) And at the same time this step greatly increased the number of discontented Slavs under Austro-Hungarian domination.

**Break-up of Dual Monarchy.** There was a fairly widespread feeling in Europe that the Dual Monarchy would break up upon the death of Francis Joseph. The outbreak of the World War made this feeling all the more certain. Indeed, when the aged Emperor-King died on Nov. 21, 1916, his well-meaning but inexperienced successor Charles faced a most difficult situation. A combination of centrifugal forces, including the tyranny of the Austrian war Government, the weakness of the new Emperor-King, the propaganda of the Allies, a series of military reverses, and the subversive activities of the hitherto suppressed nationalities, presaged an early crash of the whole Habsburg structure. In a last desperate attempt to save his throne, Charles issued a manifesto on Oct. 16, 1918, calling for the formation of an Austrian federative state with local autonomy for the member provinces. But it was too late for compromise. On Nov. 3, Austria quit the war, and on Nov. 11, Charles abdicated his imperial throne. Two days later he abdicated as King of Hungary. Since this latter act was not countersigned by a minister, however, Charles did not consider it legally binding and he later made two unsuccessful attempts to regain the Hungarian throne.

The German portions of Austria now organized themselves as a federal republic; Hungary became an independent kingdom, without a king; Croatia and the other Southslav regions were joined with Serbia and Montenegro to form Yugoslavia; Galicia was incorporated in the new Polish republic; Transylvania and Bukovina were added to Rumania; and the Northslav regions, less Galicia, were organized as the new Czechoslovak republic. The eldest son of Charles, however, Archduke Otto, continued to regard himself as pretender to the Habsburg thrones.

W. C. L.

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**AUSTRIAN SCHOOL**, a term applied to the noted group of Austrian economists who, beginning with KARL MENGER in 1871, developed and elaborated the utility theory of value, in opposition to classical cost theories. The leaders of the school were Menger, Wieser and Bohm-Bawerk. To understand the significance of the utility theory as advanced by the Austrians and by W. S. JEVONS, it is necessary to remember that English theorists, prior to Jevons, had held that the VALUE of all goods, except LAND, is determined by COST OF PRODUCTION. Borrowing from JOHN LOCKE, they had indeed gone further, and held that cost of production may in last analysis all be reduced to labor cost. They had thus inadvertently opened the way for the later socialistic attack upon the capitalistic system. KARL MARX, in his book *Capital*, published in 1867, used the Ricardian labor theory (see D. RICARDO) of value with what appeared to many as devastating logic against the existing system and its reflection in orthodox political economy. While several notable, though neglected, writers (Auguste Walras, Gossen) had anticipated the utility theory, it is probable that the Austrians were not uninfluenced in their search for a true theory of value by a desire to develop a firmly grounded theory which could not be trained on the existing economic system with subversive effect by the socialists. To this end it was necessary to get rid of the labor theory by substituting something equally logical and plausible in its place, and there can be little doubt that the labor theory has been discarded largely because of the influence of the Austrians.

Taking scarcity, in the economic sense, for granted, the basis of value is utility. This is true both of CONSUMERS' and of PRODUCERS' GOODS. The value of the latter (CAPITAL) is derived from the utility of the consumers' goods produced. Emphasizing the different orders of goods, the Austrians thus referred the value of both direct and indirect goods to utility. Cost was thus regarded as derived from value rather than value from cost. The value of producers' goods is not determined by their cost; rather their cost is what it is because of their utility in the productive process. Wieser, however, pointed out, though he did not dwell upon, the circular relation between value of product, value of the FACTORS OF PRODUCTION (producers' goods), and the cost of these factors. Cassel and others, following Leon Walras, have made this circular relation a cardinal feature in their analysis of the price system.

To the Austrians and Jevons is due the differential method of analysis which has made diminishing and marginal utility standard concepts in modern hedonistic economics. Closely related is the specific productivity theory of distribution developed in America independently by J. B. CLARK. Another outstanding Austrian contribution is Bohm-Bawerk's theory of interest, meant as a definitive answer to the exploitation theory.

After Alfred Marshall's attempt to harmonize utility and cost theories, the drift of theory has been

away from hedonistic psychology, and with the current trend toward historical and institutional analysis, the Austrian school has lost something of its former prestige.

A. B. W.

**AUSTRIAN SUCCESSION, WAR OF THE** (1740-48), a war officially concerned with the "vacancy" of the Austrian and Imperial thrones following the death of the Emperor Charles VI. By the Pragmatic Sanction he had willed his thrones to his daughter, Maria Theresa. She was loyally supported by all the Hapsburg domains, particularly Hungary, and gained the alliance of England, Holland and Russia, and from time to time smaller states. France was the backbone of the opposition in alliance with Spain, Sweden and Prussia. The war began with the invasion of Silesia by Frederick the Great, which he seized and held, with his allies, throughout the struggle.

The Anglo-French aspects of the war became worldwide, marked by the capture by colonial troops of Louisburg on Cape Breton Island and Madras by the French. By the Treaty of Aix la Chapelle, 1748, which closed the war, these points were restored, Maria Theresa was confirmed in her claim to the throne, and her husband, Francis I, was acknowledged as Emperor; the Dutch border fortresses taken by the French were returned, but Prussia retained Silesia.

**AUSTRO-ASIATIC**, a name given to a group of East-Asiatic languages spoken from Chota Nagpur in the west to Assam in the east, comprising MUNDA, MON-KHMER and Assamese (perhaps also SIAMESE), and regarded by some scholars as constituting a separate LINGUISTIC FAMILY. The term has also been extended to cover, as well, Austronesian (MALAYO-POLYNESIAN), and so even JAPANESE, PAPUAN, AUSTRALIAN, and the extinct Tasmanian, of which very little is known. The existence of the family has not yet been scientifically established; but the theory is one which deserves serious consideration.

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**AUTHOR**, one who writes or who has written novels, plays, essays or articles. See WRITER.

**AUTHORIZED STOCK**, the maximum amount of capital stock, usually stated in terms of money, which a corporation's charter or certificate of incorporation enables it to issue for capital purposes. Under the statutes such stock may be offered to the public for cash, may be exchanged for assets or disposed of for services and may be used for the payment of stock dividends, but it must not be issued for a consideration less than its par value, or, if it has no par, for less than a minimum fixed by law. Such capital represents ownership or share capital and has no relationship to loan capital obtained through the sale of bonds. It is not a debt. Capital stock represents the amount of the corporation's obligation to its stockholders but the sums invested in it may not be recovered by recourse to law. The issued shares are certificates of ownership representing the interest of the various stockholders in the corpora-

tion. A corporation may increase or reduce its capital stock by amendment to its charter or certificate of incorporation. The law does not require the corporation to issue the entire amount of stock authorized and the difference between authorized stock and that issued is known as unissued or treasury stock. Capital stock represents a corporation's nominal value.

**AUTHORS' LEAGUE OF AMERICA, THE**, founded in 1912, the national protective association for professional authors, dramatists and screen writers. The purpose of the League is to bring the authors of America into coherent and effective organization, to the end that, through the comparison of experience, the accumulation of evidence and the power of concerted action, the position of the author may be strengthened in all its business and professional relationships. The League seeks, through collective bargaining and group action, to correct abuses and inequitable practices from which authors suffer and which the individual author himself is powerless to remedy.

The Minimum Basic Agreement adopted by the Dramatists' Guild of the Authors' League of America, the playwrights' section of the League, is both a standard contract and a collective agreement with producing managers. Nearly all plays professionally produced in New York are subject to the terms of this agreement. The League also follows proposed legislation affecting authorship, opposes censorship and has been attempting to procure more adequate copyright legislation both international and domestic.

While many groups are affected by copyright, the League has been a leader in the fight for copyright reform in America. This fight has resulted in the passage by the House of Representatives of the 71st Congress of a bill (H.R. 12,549) for the complete revision of the United States copyright law providing for automatic copyright, divisible copyright, and international copyright and extending the term of copyright to the life of the author and 50 years after, a uniform term adopted by nearly all countries belonging to the International Copyright Union. In 1931 the bill was introduced into the Senate but Congress adjourned by law before debate on the bill had ceased and a vote could be taken.

The Authors' League has established the Authors' League Fund for the benefit of professional writers who, through illness or other misfortune beyond their control, are in need of temporary financial assistance. The League publishes the *Authors' League Bulletin*, a monthly periodical, for members only, which gives authoritative advice and information on the business aspects of authorship and also includes a market guide. League membership numbers approximately 2,000 writers.

I. VON A.

**AUTOBIOGRAPHY**, a literary composition in which the author tells the history of his own life. Autobiographies may be valuable for the historical or scientific data as well as for a record of a notable career. The earliest and one of the greatest works of this kind is the *Confessions* of St. Augustine. This

is a revelation of the conversion of Augustine's soul and of his intellectual and religious convictions.

Except for the correspondence of the mystics, which have great psychological value, there were no autobiographies for many years after Augustine. During the Renaissance **BENVENUTO CELLINI** wrote his *Autobiography*, in which the artist revealed not only himself but also the characteristics of his period. Later there appeared the *Confessions* of **ROUSSEAU** and the autobiographies of **BENJAMIN FRANKLIN** and **HERBERT SPENCER**. Outstanding writers of autobiography in the 19th century include **J. S. MILL**, **TOLSTOY** and **DOSTOIEVSKY**. *The Education of Henry Adams* is one of the finest American autobiographies.

**AUTO-CATALYSIS**. See **CATALYSIS**.

**AUTOCLAVE**, a strongly constructed closed metallic vessel for heating liquids under pressure to a temperature above their atmospheric boiling point. Various forms of it are employed in industry in the manufacture of chemical products. Sometimes it is equipped with a device for agitating its contents. It is also the term for a similar chamber for sterilizing dressings and other materials by heat in hospitals.

**AUTOCRACY**, a term applied to that form of government in which one person absolute and uncontrolled, wields the supreme power of the STATE. The characterization has for the most part been applied to the older despotisms of the Orient and to the Czarist régime in Russia. There may of course be tendencies toward autocracy in any form of government.

**AUTO-DA-FÉ**, meaning act of faith, a ceremony in Spain at which the sentences of the Inquisition were promulgated and, when adverse, were inflicted on the victim. The earliest auto-da-fé was held in Seville in 1482.

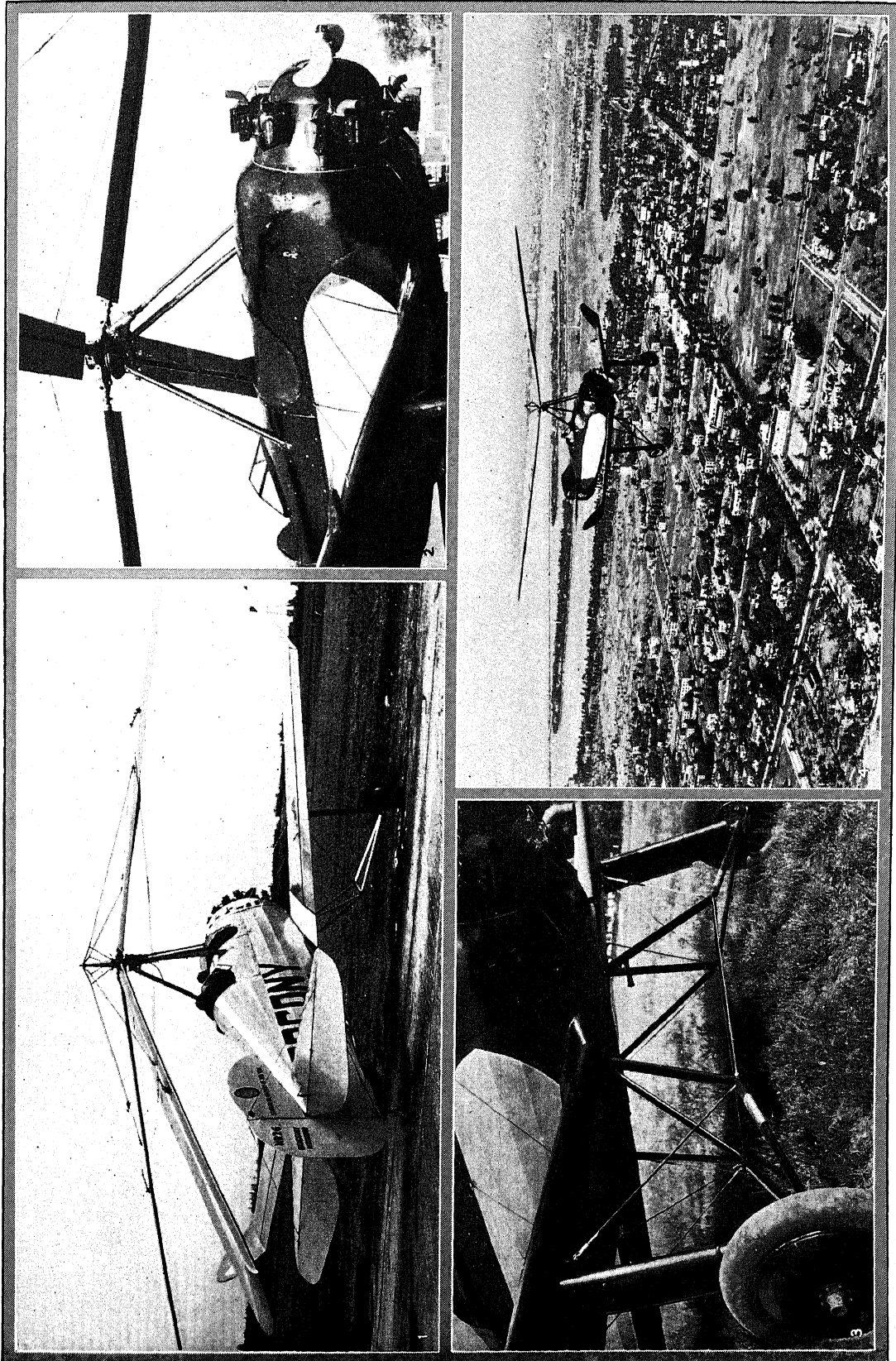
**AUTODYNE**, a radio receiver, similar to a regenerative detector (see **REGENERATION**), which is permitted to oscillate so as to create a beat note (see **BEATS**) with the incoming radio signal frequency. The device is commonly used for reception of frequency-modulated, **CONTINUOUS-WAVE**, code signals. See also **RADIO RECEIVER**.

**AUTOGAMY**, a process of self-fertilization practiced by a few plants regularly, and by nearly all when cross-fertilization fails. Such self-fertilization is only sure in cleistogamous plants, such as the violets, some milkworts, the day-flower and the dead-nettles. Most flowering plants are insect pollinated and autogamy is thus impossible. In some it is prevented by the sterility of the pollen when used in self-fertilization. See **CLEISTOGAMY**; **POLLINATION**.

**AUTOGIRO**, fundamentally, a heavier-than-air craft which derives its lift from the rotary movement of its supporting surfaces, invented by Juan de la Cierva, Spanish scientist, in 1923. It differs primarily from the **AIRPLANE** in that its supporting surfaces, or blades, are free to move at a speed independent of the speed of the machine, thereby producing unique flying characteristics. The autogiro can take off at a low speed after a very short run and immediately assume a sharp angle of climb; it can fly at either low



# AUTOGIRO



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## UNIQUE FEATURES OF THE AUTOGIRO

1. View of autogiro taking off. Note the blade mounting and position of the landing gear.
2. Close-up view of the mounting of the hinged blades.
3. Landing gear of the autogiro showing the "collapsible" mounting which absorbs much of the shock in landing.
4. Autogiro in flight.



or high speeds and can momentarily be brought to a standstill in the air. It is capable of vertical descent at a velocity slower than a man descends in a PARACHUTE, and it may be landed with virtually zero forward speed and with a shock so slight as to be easily absorbed by the landing gear.

The rotor furnishes approximately 80% of the lift at high forward speed and 100% in vertical descent. It consists of a set of hinged blades mounted on a hub which rotates on a pylon structure above the fuselage. These blades rotate freely under the aerodynamical pressure produced by the movement of the machine and are not driven directly by the power of the engine.

Inasmuch as the lift of any blade or surface is proportional to the velocity of the surface with respect to the air in which it moves, there will be a difference in the lift of the advancing and retreating blades of an autogiro rotor when the machine is moving forward. In any forward motion of the machine the rotational speed of the advancing blade is added to the forward speed of the machine while the rotational velocity of the retreating blade is subtracted from the forward speed. The lift differential thus produced would create a condition of lateral instability if the blades were rigidly attached to the rotor shaft. In order to overcome this undesirable effect, the blades are hinged to the rotor axis and are therefore free to yield upwards in the plane of the rotor shaft. This produces a slight flapping motion. As the advancing blade rises, its effective angle of incidence is decreased, while for the opposite reason the effective angle of incidence of the receding blade remains the same, or is increased. Thus each blade is made to carry its proper share of the lift automatically, and there is no force from the rotor tending to overturn the machine at high forward speeds.

A small fixed wing with upturned tips provides the autogiro lateral stability, increases its general efficiency in forward flight, carries the ailerons and provides a convenient mounting for the wide undercarriage. *See also* AERODYNAMICS; AIRPLANE. H. F. P.

**AUTOINTOXICATION**, a systemic poisoning produced by accumulation of waste substances within the body. It may arise from absorption of fecal material lodged in the bowel in constipation; from accumulation of urea or uric acid in diseases of the kidney; from accumulation in the blood of bile-forming substances when the bile-duct is blocked, or the presence in the circulation of abnormal compounds due to faulty breaking down of foods, as in diabetes.

These substances, being foreign to the bodily economy, act as depressants to nerves and muscles, and give rise to lassitude, rapid fatigue, headache, loss of appetite, and dizziness.

There is considerable reason to believe that auto-intoxication arising from chronic constipation may be due to irritation of the autonomic nervous system, rather than to absorption. This is attested to by the fact that evacuation brings such prompt relief that it is certain that poisons could not be eliminated so

quickly. *See also* DIABETES MELLITUS; FOCAL INFECTION; EXCRETION; URINE.

**AUTOLYCUS**. 1. In Greek mythology a crafty thief and the son of Mercury who stole his neighbor's sheep with perfect success until Sisyphus, marking his sheep under their hooves, at last outwitted the rogue. 2. In Shakespeare's *WINTER'S TALE*, a clever pedlar, born to be "a snatcher-up of unconsidered trifles."

**AUTOMATIC MACHINERY**, a term frequently applied indiscriminately to mechanisms in which some or all of the movements are mechanically controlled. It is more correctly applied, however, to machines in which the operation is continuous, as *full-automatic*, and to those in which the pieces to be operated on are placed in the machine by hand, as *semi-automatic*. Among machines of the full-automatic class are screw machines in which the pieces are made from a bar or reel of metal which feeds into place automatically as it is used up, and paper box machinery where the boxes are made from a continuous strip of cardboard. In the semi-automatic class are turret machines (*see* LATHES) in which the work is put in the machine by an operator after which all operations are under automatic control. The same is true of many types of drilling and tapping machines, MILLING MACHINES and GRINDING MACHINES. *See also* MACHINE TOOLS.

The two main objects of automatic machinery are to secure greater uniformity of product and to reduce the cost. Increased output is a further consideration. In many cases, the uniformity of the product is sufficient reason for installing automatic machinery; for while it may not cut the cost per piece it insures a better product and simplifies the assembly.

The lower cost of production may result from many causes among which are smaller labor cost per piece, a reduction in the waste of material, or a lower "overhead" due to saving in floor space. The installation of automatic machinery however must be carefully considered from the standpoints of first cost, interest on the investment and the probable useful life of the machine, which may be terminated by wearing out, by obsolescence due to improved machines becoming available or by a change of design in the product. The ability to utilize less skilled operators at lower wages, or the difficulty of securing sufficiently skilled men for non-automatic machines, are also factors to be considered.

Each year sees machines performing operations that were previously thought within the range of trained workers only, but it is safe to assume that most operations now performed by hand can be done by an automatic machine with greater precision and uniformity. The net saving in a transfer from manual to mechanical operation depends on the continuance of demand for the product and the cost of changes to meet new demands. For, while hand labor can easily change from one design to another, an expensive machine may be useless for a new design. F. H. C.

**AUTOMATIC PISTOL**, any pistol which reloads and cocks itself from the force of discharge of a car-

tridge in its barrel. In strict military usage, this action is called self-loading or semi-automatic. *See also* PISTOL.

**BIBLIOGRAPHY.**—Earl McFarland, *Ordnance and Gunnery*.

**AUTOMATIC RIFLE**, a small caliber, long barreled, rifled gun which reloads and fires itself after the first shot. Shoulder rifles which operate semi-automatically are frequently, though incorrectly, called automatic rifles. Several armies have developed such rifles. The United States experimental types are the Garand and Pedersen rifles.

**AUTOMATIC WRITING**, a term applied to the act of writing without the fully conscious direction of the writer. It is a form of **AUTOMATISM**. The subject may be fully awake and aware that his hand is writing and reply to questions by this means, while maintaining that the direction of the strokes as well as the ideas expressed are not his. In **HYPNOSIS**, as well as in the **TRANCE** states of **MEDIUMS**, the subject may be writing as another personality—in the language of **SPIRITUALISM**, a control—and the hand-writing may show marked changes. The phenomenon is not limited to writing. Automatic drawing and painting occur, and both have been sought as ways of tapping the subconscious sources of ideas, or to indicate the presence of **COMPLEXES** as a procedure of **PSYCHOANALYSIS**.

Automatic writing thus occurs in a state of partial dissociation. It may be slight or deep. Similarly, the relation between the contents of what is written normally and automatically may be very close—just a phase of the personality more readily released by this partly subconscious channel—or rather remote. The claims of inspiration or the revelation of material unknown to the normal personality are most uncertain; but it is not possible in many cases to trace the sources. Automatic writing is clearly more organized than automatic movements, as of tables or **OUIJA BOARD**. It is an induced condition, obtained by trial and effort to bring about a slightly dissociated state by means of distraction. Though it occurs as a symptom in nervous (hysterical) conditions, it is common in mild degree among normal persons. It may be cultivated.

J. J.

**AUTOMATISMS**, a general name for subconscious processes particularly of the motor type, that is, activities partly or almost entirely involuntary. In **TABLE-TURNING** and in directing the pointer over the **OUIJA BOARD** or the dipping of the rod in the diviner's hands, as well as in the more elaborate process of **AUTOMATIC WRITING**, the subject has a feeling that he is not consciously and by intent directing the movements. Similarly in crystal gazing, day-dreaming, or in seeing an apparition, he is not consciously inducing the images which none the less arise from within himself, though regarded as imposed from without. In **TRANCE** states there is a greater fissure or dissociation of the two kinds of activity. The actions of **SOMNAMBULISTS** and of persons in trance states are varieties of automatic behavior.

J. J.

**AUTOMATIZATION**, the integration of habits; the building up of an automatism. In the process of habit formation, attention is brought into play in connection with the acts involved. As the habit is perfected, attention lapses and the acts take place automatically. Thus the mere mechanics of talking, writing and walking represent the integration of countless habits. William James thought it was the function of education to render useful habits automatic as soon as possible.

The second meaning of the word has reference to certain types of activity that take place apart from consciousness. Such activities are manifested as automatisms and may be studied in psychiatry. They figure in the phenomena of multiple personality and other forms of irresponsible behavior. The subject is quite unaware of what he is doing when the automatism is functioning. Cases are on record of persons committing murder in their sleep. The process by which such an automatism is built up is sometimes called automatization.

**AUTOMOBILE.** *See* MOTOR VEHICLES.

**AUTOMOBILE BODIES.** Otto's gasoline engine and Dunlop's tires were installed first in a buggy chassis and body, hence the early term "benzine buggy." This was the humble beginning of the modern automobile. The very early body designs even included the curved dash and the whip socket. In 1910, the bodies had the first front doors, windshield and folding tops. Up to this time bodies were individually built by hand. As the industry developed, men of vision became body engineers and slow laborious methods were replaced by progressive assembly, machine production utilizing adequate tools and drawn steel parts. Ninety-three per cent of bodies built in 1930 were of the closed type. The body designer contends with many handicaps as height, length, width, and location of doors. He must surmount limitations and produce a beautifully proportioned body with the utmost of strength, comfort, safety and silence. Every art is called upon for its contributions: metal welding, modern lacquer finishes, color harmony, electro-plating, textile fabrics, rubber, etc. Speedier vehicles bring continually new problems as still greater strength, stream-lining to lower wind resistance, heating and ventilating developments, elimination of vibration and noise, and increased comfort to reduce driving fatigue.

F. O. CL.; A. L. Bo.

**AUTOMOBILE INDUSTRY.** During the latter part of the 18th century steam-operated, self-propelled vehicles were built, but it was several years after the invention of the gasoline engine (*see* **INTERNAL COMBUSTION ENGINE**) that such an engine appeared in a self-propelled vehicle as the one designed and built by Carl Benz of Germany. This **MOTOR VEHICLE**, though much like the ordinary tricycle, was the forerunner of the present day **AUTOMOBILE**. One of these was brought to the United States and shown in Chicago at the World's Fair in 1893.

From about 1890, several American inventors produced cars using steam or electricity and in 1894 ap-

peared the first one using GASOLINE. For the next few years there was considerable controversy as to the best form of motive power and gasoline seemed to have the poor end of the arguments. It was not until about 1900 that certain mechanical defects in the gasoline propelled vehicles were overcome and not until 1903 that the gasoline propelled vehicles took precedence over other forms of motive power. In the late '90's a few cars were produced but it was not until 1900 that organized production started to manufacture the gasoline automobile which was to start an industry destined to become one of the greatest in the world, both in respect to size and to the social influence it would have on mankind.

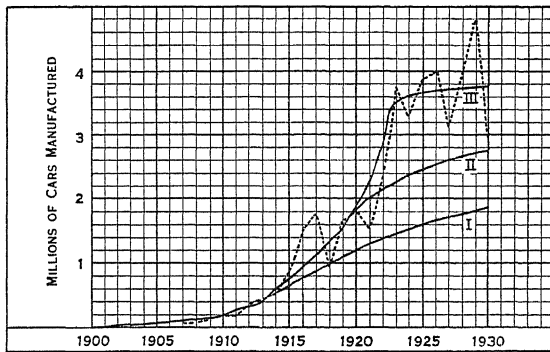


CHART OF AUTOMOBILE MANUFACTURE, SHOWING:

- I. Estimated trend excluding World War influence
- II. Estimated trend including World War influence but excluding effect of time payments
- III. Actual curve of manufactures

From the accompanying chart it will be seen that from 1900 through 1914 the motor industry experienced a rational, normal growth; that its growth was greatly accelerated by the World War inflation of purchasing power and that, beginning in 1922, the industry again experienced a tremendous stimulus by the general adoption of time payments (*see BANKING*), combined with the transition from the open to the closed cars and the introduction of minor improvements, as balloon tires and four wheel brakes.

Without the World War influence the growth of the industry would probably have followed the general trend indicated by curve 1. If the increased purchasing power, created by the war, had not been supplemented in 1922 by time payments, the industry would probably have continued along the general trace, indicated by curve 2. But by the combination of the war influence and time payments, the growth of the industry increased to an unprecedented level in 1923 after which it has shown little increase. The trend since 1923 indicates clearly that unless the industry experiences another extraordinary influence, it will continue on its present level with the growth of the future following very closely the growth of the country.

Commercial cars and trucks followed somewhat a similar course, being induced by war prosperity and the boom period which existed from 1923 to 1929 with only minor reactions.

R. B. P.

**AUTOMOBILE INSURANCE**, a contract guaranteeing indemnity for loss incurred in connection with the ownership and use of an AUTOMOBILE. In order to secure complete protection, five contingencies must be covered: loss of the car by fire or by theft, legal liability incurred by striking another person or by damaging another's property while driving, and injury done the car itself as the result of a collision.

It is not generally possible to secure full protection in one policy, as most States have passed laws forbidding it. Fire and theft insurance, they rule, may be combined in one policy and written by fire insurance companies. This policy may also and generally does insure the car against loss while being transported. Liability and property damage insurance, which in addition to indemnifying a loss also guarantees to take over any court defense of damage suits, is generally issued by casualty companies. Collision insurance is issued by both fire and casualty companies.

Because of the many factors that govern the ownership and use of an automobile, the premium rates for these policies vary widely. The principal factor is the territory in which the car is operated. The more congested the district, the higher the rate for casualty insurance. In the case of fire and theft, the age of the car is an important factor. The older the car, the higher the rate and the lower the amount of insurance possible. These factors are all combined into tables from which premium rates can be rapidly calculated.

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**AUTOMOBILE RACING.** Automobile racing, most spectacular of major sports, is not the most popular in the United States to-day although in its major contest, the International 500-mile race at the Indianapolis Motor Speedway, each Decoration Day, it does draw the largest crowd that watches any sporting event in America each year. Crowds always exceed 150,000 persons.

In the pioneering days of the automotive industry, automobile racing, the show window of a new transportation, was popular. Races were held on every possible track and road in the country. Horse tracks, even the tiny half-mile county fair tracks, were the scenes of many races between the early stars of a fascinating sport. Road races were held over tantalizing country routes. During these years factories sponsored the racing teams, and the sport was in its heyday.

Then in 1909 came the first of the specially constructed speedways, the two and one-half mile track at Indianapolis, with two long straightaways, two short straightaways and four quarter turns. The track was constructed of road material. A year later it was bricked, and in 1911 the first 500-mile race was held. The Indianapolis plant began an era of speedways. Courses of every conceivable nature were attempted. In the post-war period several bowls were built, and for a time they were extraordinarily popular. The scene of a group of cars riding the side of a board wall

at breakneck speed, hub to hub and tail to tail, was indeed a pulse quickening spectacle. But due to indifferent management, the weather wrecking the wooden speed bowls, and factories withdrawing their support from the sport, a lull was caused in national activities.

The Indianapolis race, continuing as an increasing success, was the keystone around which promoters arranged events on every possible track, even returning to mile dirt tracks, which have provided amazing entertainment for crowds in every center of the country.

**New Impetus in Sport.** Now once again, automobile racing is enjoying an unusual vogue of popularity. There is a definite reason for all this. With a change in specifications of cars for the Indianapolis race in 1929, it became possible for racing engineers to take stock cars off a salesroom floor and for a small sum of money fit them for competition in all events. This brought new blood into an anemic sport. The semi-stock cars became relatively important money winners. Once again the factories began to evidence a solid interest in a sport that had accomplished so much for the industry. It seems but a short step to active factory participation in automobile racing again. Several tracks in important metropolitan centers are being projected. The public, catching the spirit of the renaissance, has been generous in its support.

Racing is a hazardous sport. Yet there are comparatively few fatalities in competition. Successful precautions have been established not only for spectators but for competitors as well. However, each driver who has given his life on the wheel of speed, is a martyr to transportation, to a safer, faster, more comfortable mode of travel. It was on the race course that the refinements and advancements of automotive travel were tested and proven. A steering knuckle that cost the life of a driver probably saved the lives of hundreds of private drivers of passenger cars. Engineers estimate that 75 per cent of the progressive tendencies in safety and comfort in passenger cars are directly traceable to the automobile race course. That was true in the pioneering days of automobiles as well as to-day. Four wheel brakes, for instance, went from the race course to cars on the street. The first automobile contest of which there is any record in the United States was in 1895. It was the *Chicago Times-Herald* run. Thirty-one cars competed; the distance was 54 miles, and the time, eight hours, twenty-three minutes. Charles E. Duryea was the winner. It is considered more of a reliability run than a race, however. A road race of 50 miles on Apr. 14, 1900, on Long Island, N.Y., won by A. L. Riker in an electric in 2:03.30, is recorded as the first race. In those times electric cars, steam cars and gasoline driven cars were entered in races. In the same year competition began on mile dirt tracks and progressed to the splendid, well-managed racing affairs held to-day.

Big league automobile racing is governed by the rules and run under the sanction of the Contest Board of the American Automobile Association. It has proven a strict but successful governing influence.

Automobile racing is one major sport which has been untainted, through the years, by scandal.

**International Races.** Foreign competition came to America in force in 1913 when a group of drivers crossed the Atlantic to participate in the third annual 500-mile race at Indianapolis. And the foreigners were successful competitors, winning every race until 1919, the first race after the World War. From that time on, American cars and drivers have been successful. American drivers have been unsuccessful, however, in their conquests for honors in Europe. The late Jimmy Murphy, one of America's outstanding drivers, is the only speed star with an American built car to win a major European contest. He was successful in the French Grand Prix in 1921. Foreign cars and drivers are built and schooled in road racing. In America in more recent years all competition has been on tracks, rather than on roads. This is evident when the two groups meet in competition.

Straightaway speed trials over the sands of Daytona Beach, Fla., have returned to prominence in recent years. The present world's record for speed is 253.968 miles per hour averaged by Sir Malcolm Campbell of England on Feb. 5, 1932, at Daytona Beach, Fla. With a flying start, he drove his specially constructed 1,450-horsepower car, the *Bluebird*, over the 1-mile course to better his own record of 246.09. S. H.

**AUTOMORPHISM**, the tendency to judge the habits and mind of others by one's own type of mind. "Judge not that ye be not judged" is a warning against automorphism. In being severe with others one is but passing judgment on himself. Professional scandal mongers, prudes and obscenity hunters have much to learn from automorphism. In its larger aspects automorphism is a phase of the pathetic fallacy.

**AUTOMOTIVE ENGINE**, a single or multiple cylinder power plant, generally an INTERNAL COMBUSTION ENGINE of the two-stroke cycle, four-stroke cycle, Otto or Diesel types, furnishing the motive power for a MOTOR VEHICLE. It burns, as fuel, a hydrocarbon such as gasoline, kerosene, alcohol, crude oil, gas or coal dust, which are induced or injected into the cylinder where they are ignited. The force of the explosion is expended behind a sliding piston which communicates its reciprocating motion to a rotating crankshaft through a connecting rod.

**AUTOMOTIVE ENGINEERING**, that portion of technical activity which has to do with the design, construction, utilization and maintenance of all forms of self-propelled vehicles and INTERNAL COMBUSTION ENGINES or prime movers. Automotive engineering has been divided into aircraft, aircraft engine, agricultural and tractor, Diesel engine, marine automotive, motor truck and motor coach, passenger car, passenger car body, production, transportation and maintenance engineering. All of the technical aspects of automotive engineering are covered by these several branches.

In 1900, the National Association of Automobile Manufacturers was formed in New York City to foster the interests of the automobile manufacturers. A spirit



of voluntary co-operation among the engineers and executives of virtually all the manufacturers of materials, parts and complete vehicles made a standardization possible, which is probably more pronounced in the automobile industry than in any other. In 1902, the N.A.A.M. adopted the first automobile standards, which were for the spacing of tire lugs and holes, rim sections and lamp brackets. In 1904, the accessory members of the N.A.A.M. incorporated as the Motor and Accessories Manufacturers, which, in 1929, merged with the Automotive Equipment Association to form the Motor and Equipment Association. In 1903, the Association of Licensed Automobile Manufacturers was organized by the automobile manufacturers licensed under the Selden patent, and, in 1905, the American Motor Car Manufacturers Association was formed by the independent manufacturers but was succeeded, in 1910, by the Automobile Board of Trade. In 1913, the N.A.A.M. and the Automobile Board of Trade were combined into the National Automobile Chamber of Commerce and continued to support the standardization work of the Society of Automotive Engineers that had been taken over from the Mechanical Branch of the A.L.A.M. in 1910. Thus, the automotive engineers established a policy of standardization which has so far resulted in more than a thousand automotive standards, which is estimated to have saved automotive users millions of dollars annually. The Automotive Research and Standardization Committees, international in their scope, deal with a great variety of subjects, including: Specifications for raw materials; Uses and conservation of resources; Comparative tests of operation; Resultant legal aspects; Public safety; Engineering forecast, and hundreds of other subjects of vital interest to the automotive industry. Their findings and recommendations form much of the textbook material now in use in the handbooks and textbooks of our schools and universities.

J. A. C. W.

**AUTONOMIC NERVOUS SYSTEM**, a division of the nervous system carrying impulses which regulate the activity of visceral structures, such as heart, lungs, digestive tract, blood vessels, and glands. It differs from the sympathetic nervous system in that it does not include sensory visceral pathways, as does the latter, but does include representations in the brain and spinal cord, which the latter does not. In other respects the two terms refer to identical structures. It is composed of two portions: craniosacral and thoracolumbar, which have opposing functions. In general, a contingent of each component runs to each structure innervated. *See also* SYMPATHETIC NERVOUS SYSTEM.

**AUTONOMY**, in general means independence or self-government. Complete autonomy is a characteristic of a sovereign state. Very frequently, however, the term carries with it, by implication or otherwise, an indication that the grant of independence has been limited. Thus municipalities are granted local autonomy for the solution of their peculiarly local problems. Similarly imperial states grant varying de-

grees of autonomy to subject peoples under their dominion.

**AUTO-OXIDATION**. *See* OXIDATION AND REDUCTION.

**AUTO PLATE**, a stereotyping machine that casts and finishes curved plates. To cut down the time between closing of the forms and starting of the press, an auto plate has been developed capable of producing six complete plates a minute, cast, cooled, shaved and trimmed ready for the press.

**AUTOPSY**, the medical examination of a body after death, conducted to find the cause for death, whether natural or violent, and to determine such abnormal changes in the organs as may have occurred as the result of disease.

The examination includes external inspection of the body, study of the internal organs, chemical analyses, bacteriological tests, and microscopic study of tissues.

The *external examination* is made with reference to appearance indicative of the time of death and the position in which the body has lain for some time after death. Marks of violence, or any other marks, from any cause whatever, pointing to the cause of death are searched for.

In determining the time of death, the following factors are important: (1) The presence and extent, or absence, of rigor mortis, which is stiffness or rigidity of the muscles that occurs after death; (2) the incidence, extent and color of post-mortem lividity, which is discoloration of the skin; (3) the presence, character and extent of putrefaction.

In determining the cause of death, the following are of importance: (1) All marks indicative of violence; this includes the location of bruises, wounds, cuts, and burns, or the engraving of the skin with carbon particles; (2) marks on the neck resulting from choking; (3) marks of burning from fire, scalding fluids or corrosives; (4) external examination of the spinal column and skull, with reference to fractures.

In the *internal examination*, all the organs of all the cavities of the body are carefully inspected, even though the apparent cause for death has been found in one of them.

In cases where there are suspicions of poisoning, careful attention is paid to the condition of the mouth and the entire intestinal tract. The stomach and intestinal contents must be preserved for chemical analysis. The liver, spleen, kidneys and urine obtained from the bladder must also be preserved for further analysis. Under aseptic methods, a sample of blood from the heart is taken, before that organ is opened and preserved for bacteriological and chemical studies where indicated.

After the chest and abdominal cavities have been opened by a cut down the middle of the body, the examiner, by feeling can determine the amount of blood contained in the chambers of the heart. The skull can then be opened and the blood condition of the brain itself and the brain membranes observed. Then the examiner can proceed to study the indi-

vidual organs of the chest and a like examination of the abdominal organs.

In cases of fatal wounding, especially where the wound is a penetrating one, great care is taken not only in determining its dimensions, but also in tracing its direction. This will throw light upon the relative positions of assailant and assaulted at the time when the deed was committed. W. I. F.

**AUTOSUGGESTION**, a phenomenon, somewhat similar to hypnosis, in which the subject acts upon his own suggestion rather than that from another. Delusions, phobias and compulsions are often due to autosuggestion, and complexes may frequently be traced to it. Autosuggestion may be used in the treatment of pathological symptoms.

**AUTO TRUCK.** See TRUCK, MOTOR.

**AUTUN**, cantonal capital in the department of Saône-et-Loire, France, situated in an amphitheater on the slopes of the Arroux. It has many ancient remains, the cathedral completed in 1178, museums and a library rich in manuscripts and incunabula. Autun is the seat of a bishop, is active in intellectual life, and has advanced schools, including a theological seminary. It manufactures machinery, chemical and other products and has a brisk trade. Seat of the Druids, it was taken in turn by Romans, Germans, Huns, Burgundians, Arabs and Normans. TALLEYRAND was Bishop of Autun. Pop. 1931, 14,045.

**AUXENTIUS OF CAPPADOCIA**, Arian Bishop of Milan. See AMBROSE OF MILAN.

**AUXERRE**, capital of the department of Yonne, France, located on the Yonne River, 55 mi. northeast of Nevers. It has Roman ruins, a fine Gothic cathedral of the 13th century, the cornerstone of which was laid in the 4th century, an episcopal palace, museum, library, college, city hall and palace of justice. It was the seat of a bishop since the 3rd century. Chlodwig, king of the Franks, captured Auxerre, and after changing hands several times, the town was purchased by France in 1370. It was ceded to Philip of Burgundy in 1435, but reverted to the French crown after the death of Charles the Bold, 1477. Pop. 1931, 22,900.

**AVALANCHE**, a sudden snow-slide from a steep mountain shoulder. Avalanches are normal features of mountain economy, tending to follow fixed tracks. Thousands of slides are arrested in upper altitudes. They become exceedingly destructive when they ravage populated slopes believed safe, or when, gathering immense mass and momentum, they plunge down into valleys, burying roads, cutting railway lines, and engulfing settlements. In 1888 a great new avalanche killed 145 persons in the Italian Alps. In 1923 the Mt. Cenis tunnel was cut, and 200,000 cubic metres of snow deluged the village of Roberts.

Cold avalanches, of dry compacted snow, break away with a report like artillery. The foot of a chamois may start such a slide. They attain appalling velocity, estimated by some authorities at 190 to 250 miles an hour. The accompanying wind-blast fells

acres of timber. Warm avalanches of wet snow, also called ground-avalanches, are retarded by the burden of foreign matter they carry. In 1914 an avalanche near Chamonix brought down 2,000 cubic metres of earth and rock. The average course of the greater avalanches is about 8,000 to 13,000 ft.

Avalanches occur in the Rockies, and are common in the Cascade Range, Washington, and other regions of Alpine peaks.

**AVALON**, a seaside and deep-sea fishing resort, situated on the southeastern shore of SANTA CATALINA ISLAND, California; approximately 50 mi. south of Los Angeles and 30 mi. by steamer across the San Pedro Channel from San Pedro and Long Beach. It is the only town on Catalina Island and is picturesquely situated in a narrow valley surrounded by low rugged mountains. Thousands of tourists and fishermen from all parts of the world visit the island, especially from May to November. Avalon has excellent hotels, a large "tent city" and numerous attractions, in addition to climate, scenery and fishing grounds. Catering to the transient population is the chief occupation of the permanent inhabitants of Avalon. Pop. 1920, 586; 1930, 1,897.

**AVALON**, a residential suburb of Pittsburgh's industrial district and a borough of Allegheny Co., in southwestern Pennsylvania, situated 6 mi. northwest of Pittsburgh. The borough is on the Ohio River and is served by the Pennsylvania Railroad. It was incorporated in 1873. Pop. 1920, 5,277; 1930, 5,940.

**AVARS**, a Tatar tribe, which late in the sixth century founded a vast but ephemeral empire on the lower Danube. Between 581 and 600 they ravaged the Balkan peninsula. In 610 they raided northern Italy. Sixteen years later they joined the Persians in a vain attack on Constantinople. They reached the height of their power in the 8th century, when they brought the whole of central-eastern Europe from the Baltic to the Black Sea under their hegemony. They were finally subdued by Charlemagne in 805, and their state was broken up.

**AVEBURY**, a village in Wiltshire, England, situated on the upper Kennet River, 6½ mi. west of Marlborough. The village lies within Avebury Circle, a remarkable stone monument inclosing an area of 30 acres, comparable to STONEHENGE and built possibly in the late Neolithic period. Pop. 1931, 525.

**AVELLANEDA**, a city of Argentina, situated across the Riachuelo River from Buenos Aires, and really a suburb of that city, but with its own municipal government. It has immense packing houses and extensive docks, with large manufactures of textiles. Several bridges span the river between the two cities, and motor buses, street-cars, and railway trains connect them. Est. pop. 1930, 193,431.

**AVELLINO**, a city of south central Italy, capital of the province of the same name. It lies in an Apennine valley, whose good climate and fertile soil make profitable the cultivation of grain, grapes, olives, vegetables and fruit, in which the town has a brisk trade. There are also small local industries. The 10th cen-

tury cathedral is the most noteworthy building, though the Palazzo della Dogana, the museum and other buildings are also of interest. The ancient town was captured by the Lombards, and Christianity was introduced at the latest in the 4th century. Avellino's history is closely connected with the neighboring duchy of BENEVENTO. Pop. 1931, 27,445.

**AVE MARIA**, *see* ANGELUS.

**AVENTURINE**, a name usually applied to QUARTZ containing glistening scales of hematite or other bright minerals. The color is red, brown, green or yellow. It is found in Siberia, China and Madagascar. By stirring copper filings into molten glass, an imitation called gold stone is manufactured for use in cheap jewelry. Sunstone, or aventurine OLIGOCLASE, is a feldspar colored yellow or red by included crystals of iron oxide, found in Norway. *See also* PLAGIOCLASE; GEM STONES.

**AVERAGE**, a single representative value taking the place of many items for the purpose of comparison. The term also means a measure of central tendency, descriptive of a distribution of observations about a central value; the most probable value in a larger universe of which only a part has been investigated, as a sample; or a norm about which individual deviations or the dispersion of the entire distribution have been measured.

Statistical method, of which the theory of averages is a part, is concerned with variables, that is, with quantities which are not constant in value for a given characteristic, as age or income, but which vary over a range of values for different items possessing the trait.

The chief kinds of average are the arithmetic mean, the median, the mode and the geometric mean, each appropriate for particular types of data. The arithmetic mean, which is the sum of the various items divided by the number of items, is often rendered unrepresentative by the influence of extreme variants, as in a distribution of incomes. To secure a more typical value in such distributions the median or mode may be used. The median is a position average obtained, after arranging the items in order of magnitude, by locating the value which has an equal number of cases above and below it. The mode is also a position average, unaffected by extreme variations, the value which is repeated most frequently. It is significant when the items show a tendency to concentrate about a central value and more than one mode may appear in the same distribution.

The geometric mean of  $n$  items is the  $n$ th root of the product of the separate items. This average gives equal importance to equal ratios, and is especially appropriate in averaging rates and percentages, as in constructing INDEX NUMBERS. *See also* LEAST SQUARES; STATISTICS.

R. E. CH.

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**AVERNUS**, the *Lacus Avernus* of the ancients, a lake famed in classical literature situated in Campania in Italy near the promontory extending into

the sea between Cumae and Puteoli. In ancient times and to-day the lake occupied the crater of an extinct steep-sided volcano about  $1\frac{1}{2}$  mi. in circumference. In 37 B.C. Agrippa made Avernus into a naval harbor and connected it with the Lacrine Lake; in 1530, Monte Nuovo, rising beside the lake, erupted and destroyed the canal and harbor, leaving the lake in its original state. In classical poetry Avernus is the entrance to Hades and the abode of the Cimmerians, a people who lived in constant darkness. Nearby is the cave of the Cumaean Sibyl.

**AVERROËS** (1126-98), known also as Ibn-Roshd, an Arabian philosopher of the West, was born at Cordova in 1126. In 1169 he became judge of Seville and later of Cordova. He was one of the most famous commentators on ARISTOTLE. Principal among his doctrines, known as Averroism, is the disbelief in immortality. Averroës died at Morocco in 1198.

**AVERY, SAMUEL** (1865- ), American educator, was born at Lamoille, Ill., Apr. 19, 1865. He graduated from the University of Nebraska in 1892 and from Heidelberg University in 1896. In the next 12 years he was connected with the department of chemistry of the University of Nebraska and from 1908-27 was chancellor. Avery has lectured extensively on education and has written many technical bulletins and textbooks on chemistry.

**AVES**. The name applied to the class of warm blooded vertebrate animals comprising all birds and holding equal zoological rank with fishes, reptiles and mammals. Birds are feathered bipeds, with four or three toes, the ostriches alone having two toes. *See* BIRDS.

**AVESTA**, an extinct language of the East Iranian division of the INDO-IRANIAN group of the INDO-EUROPEAN linguistic family, containing as its sole known literature the sacred books of ZOROASTRIANISM. Linguistically it is closely akin to OLD PERSIAN and is preserved in two dialects: one ("Gathic") of an archaic type comparable to Vedic (*see* SANSKRIT); the other ("Younger Avesta") of later date and less intricate structure. The age of these documents is much disputed. The Gathic dialect, contained chiefly in *Gāthās* ("Songs") traditionally ascribed to Zoroaster, would come, assuming the traditional date of Zoroaster as correct (660-583 B.C.), from the 7th century B.C. The period of the Younger Avesta, though containing a vast amount of material antedating Zoroaster, much interpolated, and in part very corrupt linguistically, is even more uncertain. One can say with certainty only that the present material is about one-quarter of the original amount, and that what survives was in its present form in the 3rd century A.D. The exact provenance of the Avesta dialects is likewise uncertain, the most plausible view being that they came from an area roughly corresponding to the modern Azerbaijan in northwestern Persia and also to ancient Media. Scientific investigation of the language is further hampered by its script, which is of Aramaic origin, so awkwardly modified to represent Indo-Iranian words and forms that Avesta

must be checked very carefully in studying linguistic problems in which it is involved. L. H. G.

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**AVIARY**, a large enclosure in which captive birds are kept. The aviary may be an indoor room, an enclosed outdoor space or a combination of the two. Outdoor aviaries are most general in southern Europe where tropical birds do not suffer from exposure. Open-air aviaries in northern countries are possible for hardier birds if they are protected by shrubs, rocks and shelters. Indoor aviaries require moderate heating; they must be vermin proof, easy to clean and not too brilliantly lit. For both types an abundance of pure water and food, and facilities for nesting must be supplied.

**AVIATION.** See AIRPLANE; AIRSHIP; AIR TRANSPORTATION; MILITARY AVIATION; NAVAL AVIATION, etc.

**AVIATION, HISTORY OF.** In 1782 one of the first ideas of the practicability of man's flying was conceived by Tiberius Cavallo, an Italian, while amusing himself by filling soap bubbles with hydrogen gas and watching them fly. He became so interested in the rapidity with which these bubbles rose and in the fact that they remained intact for a long time that he wrote a treatise on his experiment.

Among those who read this treatise with interest were the Montgolfier brothers (see MONTGOLFIER, JOSEPH MICHEL). They constructed a paper bag, 105 ft. in circumference, which they inflated with hot air. On June 5, 1783, this bag rose 6,000 ft. and traveled almost 1½ mi. before falling. From then on numerous experiments in balloons were made.

The first balloon flight across the English Channel was made by a Frenchman, Pierre Blanchard, and Dr. John Jeffries, an American, on Jan. 7, 1795. In 1852 Henri Gilford, a Frenchman, manufactured a balloon shaped like a cigar. The machine was 143 ft. long, 39 ft. in diameter, and was propelled by a 110 lb. steam engine producing 1 h.p.

In the next year an American, John Wise, piloted a balloon from St. Louis to New York, a distance of 1,120 mi., and set a record which stood for some time.

One of the most important events in the history of aviation was the flight of OTTO LILIENTHAL in 1891. His machine was a glider which resembled a large bird. He launched himself by running down a slope against the wind. The next milestone in aviation was marked by SAMUEL PIERPONT LANGLEY in 1896. His plane, the nearest forerunner of modern planes, was propelled by a steam engine.

In 1900 COUNT ZEPPELIN introduced a rigid airship. It consisted of a row of 17 balloons confined in a covering 416 ft. long and 38 ft. in diameter, with pointed ends. It was propelled by two 16 h.p. engines. With 5 passengers aboard, this ship traveled almost 4 mi. in 17 min. in any direction.

The Wright brothers (see WRIGHT, ORVILLE; WRIGHT, WILBUR) began experimenting and in 1903 launched a plane at Kitty Hawk, N. C. This marked the first flight in history in which a machine carrying

a man had raised itself into the air by its own power, had sailed forward on a level course, and landed safely.

The period between the Wright brothers' first flight and the World War was marked by the exploits of such men as Louis Bleriot, who in 1909 crossed the English Channel in a heavier-than-air craft, GLENN HAMMOND CURTISS, with his experiments with land and sea planes, and Glenn L. Martin.

With the advent of the World War, the indispensability of aircraft and the practical uses of flying were recognized. Following the war, the aviation industry entered a dormant stage which lasted until 1928, when again the industry took on new life in the development and production of aircraft. In 1933 there were over 17,000 mi. of lighted airways in the United States. Transport lines of America carry more passengers, mail and express, and fly more miles than all airlines in the rest of the world combined. A. I. L.

**AVIATOR**, the pilot of an AIRPLANE. The professional aviator finds employment either on an air transport line or in flying for some one of many aerial services such as photographic survey or crop dusting from the air. The first step in qualification is the taking of a primary flying course, which requires a total of 15 to 30 hours in the air to qualify for the most elementary grade of license. Progress is made thereafter by additional practice under varied conditions. To qualify for employment as a pilot on a transport line in general requires a minimum of at least 1,000 hours of flying. Aside from this training qualifications for success are mainly temperamental. Normal physique, especially in vision, and good nervous and mental stability are essential. E. P. W.

**AVICENNA** (979-1037), Persian physician and philosopher, was popularly called in his period the prince of physicians, whose influence extended through the Mohammedan world and in the West of Europe. He was vizier to the Prince of Hamadan when 18 years old, but due to court intrigues was compelled to flee to Isfahan, where he became court physician and a lecturer on medicine and philosophy. It is said he wrote 100 books and at 21 an encyclopedia of all sciences except mathematics. Some experts claim that the quatrains ascribed to Omar Khayyam were written by Avicenna. He died in 1037. M. F.

**AVIGNON**, a walled city, capital of the department of Vaucluse, southeastern France, situated on the east bank of the Rhône, about 20 mi. northeast of Arles. Avignon in the Middle Ages was held chiefly by the kings of Burgundy and the counts of Provence and Toulouse. It was the residence of the Popes, beginning with Clement V, during the so-called Babylonian Exile, 1309-77, and remained a papal possession until it was annexed by the French National Assembly, after violent fighting, late in the 18th century. Its outstanding architectural monument is the Papal Palace, which is both fortress and castle. Of special interest in the 13th century Romanesque cathedral of Notre Dame des Doms is the Gothic mausoleum of Pope John XXII, who died at Avignon in 1334. Also of interest are the remaining

arches of the bridge built across the Rhône by St. Bénézet in the 12th century, the famous *Pont d'Avignon* of the old song. Avignon manufactures oil, soap, flour and chemicals. Pop. 1931, 57,228.

**AVOCADO**, improperly called alligator pear, a tree (*Persea gratissima*) of the laurel family, often 50 to 60 ft. high. It is indigenous to the West Indies, Mexico, Central America and adjacent South America, but is widely cultivated for its large plum-like fruits in tropical and sub-tropical countries throughout the world. These fruits vary in size from 1 to 8 in., in weight from 2 oz. to 4 lbs., and in color from green to purple, crimson and maroon. In some the skin is soft and thin, in others rough, hard and thick. The edible part is the cream-colored, buttery flesh which surrounds the large stone. Unlike most other cultivated fruits the avocado is rich in oil. For this reason it is classed as a salad, rather than a dessert fruit and is usually eaten with salt, pepper and an acid, such as lemon or vinegar.

Prior to 1900 the tree was propagated solely by seed, with the result that many trees produced inferior fruit. The choicest varieties are now propagated by budding. As certain varieties grow and ripen their fruit in Mexico at altitudes of 7,000 ft. where heavy frosts are common, it is probable that some of these will be introduced into many parts of the United States, perhaps even Canada. At present commercial plantations in the United States are found chiefly in California and southern Florida. M. G. K.

**AVOCET**, a long-legged, long-necked shore bird with long, upturned bill, whence the family name *Recurvirostridae*. The American avocet (*R. americana*) breeds from Texas to Saskatchewan, and winters on the Gulf Coast, in Cuba and Central America, migrating through California and Arizona. It has a light brown head and neck, white body and black wings marked with white, blue legs with the front toes joined by webs. It feeds in shallow water with a side-to-side movement of the bill. The European avocet (*R. avocetta*) has the top of the head and back of the neck black, with more white on the wings. The Chilean avocet (*R. andina*) is like the American, but with no white bars on the wings. The name of the Australian red-necked avocet (*R. novae-hollandiae*) sufficiently describes it. All are from 16 to 20 inches long.

**AVOGADRO, AMEDO, Conte di Quaregna** (1776-1856), Italian physicist, was born at Turin, Aug. 9, 1776. In 1811 he discovered the principle, since named Avogadro's Principle or Constant, that at the same pressure and temperature all gases contain the same number of molecules per unit volume. He died at Turin, July 9, 1856. See also ATOMIC WEIGHTS.

**AVOGADRO'S HYPOTHESIS** states that, at the same temperature and pressure, equal volumes of all gases contain the same number of molecules. Accordingly, the number of gaseous molecules in a standard unit of volume at a specified temperature and pressure must be a fundamental constant of nature, quite independent of the nature of the gas.

When the standard volume is taken as that volume in which there is contained one molecular weight of a substance, the resulting constant is called *Avogadro's constant*. While it is, of course, not possible actually to count molecules, the value of Avogadro's constant has been determined by a wide variety of indirect methods which, considering their diversity, agree surprisingly well. The best value in the light of present evidence is  $6.06 \times 10^{23}$ . Since under ordinary room conditions, the gram-molecular-volume is about 24,000 cubic centimeters, this means that one cubic centimeter of ordinary air contains about 25 billion billion molecules. See also MOLECULE. L. O. C.

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**AVOIDANCE**, a term applied in anthropology to a special social phenomenon dealing with the restriction of social intercourse between relatives. Avoidance is most frequently manifested in the restriction of the use of the name of an individual related by blood or marriage, restrictions against addressing such a person and restrictions against eating in the presence of certain relatives. Perhaps the most classic examples of such restrictions are the widely distributed customs among all primitive peoples of the avoidance by the mother-in-law of a son-in-law, or a woman and her father-in-law, and *vice versa*.

**AVOIRDUPOIS WEIGHT**, a system of weights used for all commodities except gems, precious metals and medicines. The system is based upon the GRAIN, 252.458 of which comprise the weight of a cubic inch of water and 7,000 of which make a POUND avoirdupois. The pound is divided into 16 ounces and the ounce into 16 drams.

#### Avoirdupois Weight

27.34375 grains = one dram

16 drams	= 437.5 grains	= 1 ounce
16 ounces	= 7,000 grains	= 1 pound
100 pounds		= 1 cental
2,000 pounds		= 1 short ton
2,240 pounds		= 1 long ton

#### Also, in Great Britain

14 pounds	= 1 stone
2 stones = 28 pounds	= 1 quarter
4 quarters = 112 pounds	= 1 hundredweight (cwt.)
20 hundredweight	= 1 long ton

**AVON**, the name given to three important and several smaller rivers in England. 1, The Upper, or Shakespeare Avon, rises in Northamptonshire and flows 100 mi. before joining the Severn in Tewkesbury. Some trade is carried on in the locked part of this river. 2, The Lower, or Bristol Avon, with its source in the Cotswold Hills, is about 75 mi. long, entering the Severn at Avonmouth. It is important commercially because of shipping from Bath and Bristol. 3, The East, or Hampshire Avon, rising in Wiltshire, passes through the Vale of Pewsey, Amesbury and Salisbury, entering the English Channel through Christchurch Harbor. It covers a drainage area of

1,130 sq. mi. and is noted chiefly for its salmon fisheries.

**AVOYEL**, an extinct North American Indian Muskogean group which in the 18th century lived near the mouth of the Red River in Louisiana. They were a typical people of the Gulf area, agriculturists and village-dwellers. Early in their history they acquired European domesticated animals, horses and cattle, which they bred and sold to French settlers. Close contact with the settlers as well as wars and disease eliminated their aboriginal culture and language, and the few survivors in the early 19th century were absorbed in the surrounding white population.

**AVUNCULATE**, the duties and privileges of the maternal uncle in certain forms of primitive society. Where kinship and inheritance are matrilineal, and the brother becomes automatically the guardian of his sister, the position of maternal uncle becomes one of considerable authority. The training and tribal initiation of his nephew, and the selection of a husband for his niece, are probably among his responsibilities and rights. Where the institution of cousin-marriage exists, the son of the maternal uncle usually has first right to his cousin's hand.

**AWL**, a hand instrument with a slim, sharp point that makes a hole by forcing aside the particles of wood, leather or other substance in which a hole is to be made. It resembles a domestic ice pick.

**AX**, a hand tool for cutting or forming wood. It has a handle long enough to permit the use of both hands, by which it is "swung." The head is heavy and generally blunt on one edge and sharp on the other, the blade being parallel with the handle. The end of the handle fits in an eye forged in the head. The flat side of the head is frequently used for driving stakes and similar work. The ax used in felling large trees is usually double edged or "bitted."

**AXIOM**, a proposition the truth of which does not admit of proof, and which is assumed to be self-evident. Such a proposition may be used to prove other propositions, as in the case of geometrical axioms, but its own truth cannot be demonstrated beyond its immediate appeal to reason. That things equal to the same thing are equal to each other and that A is A are examples of axiomatic truths. They represent that initial point without which it is impossible for thought to proceed demonstratively.

Axioms differ from postulates in that self-evidence is not necessarily assumed in the latter. Every science has its axioms and postulates, the presuppositions upon which it is based. What is an axiom for one age may not be so for another. Euclidean geometry was accepted as axiomatic to Newtonian physics, but with the recognition of types of space not tridimensional, other systems have been evolved. It is upon such a possibility of variant geometries that Einstein's theory of relativity is based.

**AXIS**, a straight line passing through a plane figure in such a manner that different parts of that figure are symmetric. An axial plane is one passing through a regular solid and cutting it into symmetric parts.

In analytic geometry, an axis is an arbitrarily selected straight or curved line of reference for determining the position of a point or of a set of points of a curve or surface. See SYMMETRY; ANALYTIC GEOMETRY.

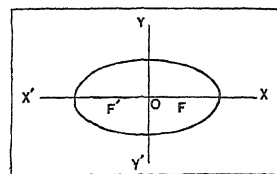
#### AXIS, MAGNETIC.

See MAGNETISM.

#### AXIS, OPTIC. See

DOUBLE REFRACTION.

**AXLE**, a shaft, or pin, on which a WHEEL is mounted. One type of axle is fixed and the wheel rotates around it; a second type revolves in bearings



AXES OF SYMMETRY OF AN ELLIPSE

and has the wheel fixed to it. The part which makes contact with bearings is called a *journal*, and that which fits inside the hub of the wheel, a *spindle*. Revolving axles may be driven by a motor or engine directly, or through a set of gears. In the AUTOMOBILE driving axle, two separate shafts are connected through a DIFFERENTIAL, and the whole system is enclosed in a secondary axle, or housing, which carries the load.

**AXOLOTL**, the old Aztec name given to the larva of the "tiger salamander" (*Amblystoma tigrinum*). For a long time it was not known that the axolotl and the tiger salamander were the same animal, because the axolotl can reproduce while in the larval stage. In some lakes where the water is cold and the food abundant, while the surrounding country is unattractive for a terrestrial animal, it seems never to change into a true land-living adult, while in other places, especially where the water dries up, or becomes uninviting, it regularly completes its metamorphosis. The axolotl is gray or whitish in color, about 7 in. long, and has branching external gills. Changed into the tiger salamander it is blackish, with yellow spots, and has lungs instead of gills. It is found in the United States and Mexico.

**AYDELOTTE, FRANK** (1880- ), American educator, was born at Sullivan, Ind., Oct. 16, 1880. He graduated in 1900 at Indiana University and was a Rhodes scholar to Oxford from 1905-07. Aydelotte taught English at Indiana University from 1908-15 and was professor of English at Massachusetts Institute of Technology from 1915-21, when he became president of Swarthmore College. Among his published writings are *College English*, 1913, and *Elizabethan Rogues and Vagabonds*, 1913. He also edited several works including *Materials for the Study of English Literature and Composition*, 1914, and *English and Engineering*, 1917.

**AYE-AYE**, an extraordinary lemur inhabiting the bamboo-forests of Madagascar, where the natives regard it with superstitious terror. Its disproportionately large eyes and great rounded ears, give it a spectral appearance increased by the enormously elongated, spidery middle finger, used to dig out wood-boring grubs on which, with vegetable juices, it feeds. It is a dark brown animal, the size of a cat, with a long bushy tail. The teeth are squirrel-like, but the foot, with its opposable great toe, places the animal (*Dau-*



*bentonia madagascariensis*) among the inferior primates. It is arboreal and nocturnal in habit and is one of few mammals to build a regular nest.

**AYER**, a town including a village in Middlesex Co., northeastern Massachusetts. Ayer is well-situated about 36 mi. northwest of Boston and is served by the Boston and Maine Railroad. It has a tannery, cutlery and machine shops, furniture, glue and other factories. The principal crops of this district are apples and peaches. The vicinity of Ayer was settled about 1662; the town was set off from Groton in 1871. Near by is Camp Devens, a training camp during the World War, which later became an established army post, now used as a summer training camp. Pop. 1920, 3,052; 1930, 3,060.

**AYISHA** or **A'ISHA** (613-678), the favorite wife of MOHAMMED, was the daughter of Aby Bakr (father of the virgin), the first khalif, or successor of the Prophet. She was born in Mecca, and when nine years old was wedded to Mohammed in Medina. Ayisha has remained a sacred personage to the majority of Moslems. After Mohammed's death she often interposed in politics. She and Ali were bitter enemies. She was often consulted by the Moslems on matters of theology and law, and is held responsible for over a thousand traditions from the mouth of the Prophet. Ayisha died and was buried in Medina.

**AYLESBURY**, a municipal borough of Buckinghamshire, England, lying 38 mi. northwest of London in the fertile Vale of Aylesbury. A 14th century Franciscan monastery has disappeared, but there is the Early English Church of St. Mary which, though largely restored, traditionally occupies the site of a Saxon church that once contained the bones of St. Osith. **DISRAELI** often delivered speeches in Aylesbury when a member of Parliament. The locality is famous hunting country and in 1835 was the scene of the first point-to-point race in England. The town has a considerable agricultural trade and is noted for duck-rearing. Pop. 1921, 12,114; 1931, 13,382.

**AYLESFORD**, a town in Kent, England, situated on the Medway River, 38 mi. southeast of London. Nearby is a neolithic dolmen, consisting of three upright sarsen stones, eight ft. high, transversely crossed by a 12-ft. stone. Pop. 1931, 3,113.

**AYMARA** or **AYMARAN**, an important linguistic stock of South American Indians, comprising various semi-civilized tribes centering in the region around Lake Titicaca in the southeastern part of ancient Peru. At the time of the Spanish conquest the Aymara tribes, of which the outstanding were the Collas, Lupacas and Pacasas, had long been under the domination of the Inca tribes. Many authorities hold that the ruling class of the Inca and the Incan civilization was of Aymaran origin. In physical stature the modern Aymarans are short but are noted for their tremendous chest development.

**AYR**, a royal burgh and county seat of Ayrshire, Scotland, situated at the mouth of the River Ayr, 41 mi. southwest of Glasgow. It has a harbor and sea-bathing. Industries include shipbuilding, textile and

shoe factories. A little over 2 mi. away is Alloway-on-the-Doon, the birthplace of ROBERT BURNS. Pop. 1931, 36,784.

**AYRES, LEONARD PORTER** (1879- ), American financial expert, was born at Niantic, Conn., Sept. 15, 1879. He graduated from Boston University in 1902 and spent six years in educational work in Porto Rico. From 1908-20 he was educational director of the RUSSELL SAGE FOUNDATION. In 1920 he became vice-president of the Cleveland Trust Co. (see CLEVELAND FOUNDATION) and in 1924 economics adviser to the Dawes Plan Committee.

**AYRSHIRE**, a county rich in harbors in southwest Scotland on the coast of the Firth of Clyde. It embraces three districts, Carrick in the south, Kyle



FROM JEPSON, MAN. FL. PLANTS CALIF., COPYRIGHT  
WESTERN AZALEA

in the center, and Cunningham in the north. The land in the southeast is mountainous, but more than 50% is cultivated. Besides cattle raising, there is coal mining and stone quarrying, and a cotton and woolen industry. Pop. 1931, 285,182.



PURPLE AZALEA

**AZALEA**, a name commonly applied to numerous species of *Rhododendron* which usually bear deciduous leaves. They differ from the true rhododendrons

chiefly in having funnel-form instead of bell-shaped flowers. By some botanists the 40 or more species of this group, natives of North America and Asia, are regarded as a genus distinct from *Rhododendron* called *Azalea*. Among the eight species or ten native to the United States are some of the most handsome of North American flowering shrubs, notably the flame azalea (*R. calendulaceum*) of the southeastern states, the purple azalea or pinxter flower (*R. nudiflorum*), widespread in the eastern and southern states, the white azalea (*R. viscosum*) of similar range, and the western azalea (*R. occidentale*) with white flowers, found in the Pacific states, all more or less planted for ornament. See also RHODODENDRON.

**AZAN** or **ADHAN**, the Moslem call to prayer. See MUEZZIN.

**AZARIAH**, a Hebrew name meaning "Helped of the Lord," which was borne by no fewer than 22 Scriptural characters. (Consult a full concordance of the Bible.)

**AZERBAIDJAN**, one of the three Soviet Socialist republics of **TRANSCAUCASIA**, situated in the extreme southeastern part of European Russia adjoining northwestern Asia. It is bounded on the north by Dagestan and Georgia, on the west and southwest by Armenia, on the east and southeast by the Caspian Sea and on the south by Persia. It embraces an area of 32,400 sq. mi., mostly plain and plateau. Azerbaidjan, formerly a part of Persia, is mainly an agricultural state, producing grain, tobacco, cotton, fruits and vegetables. Stock-raising is the chief occupation of the inhabitants in the mountainous districts. There are many oil wells, especially in the Baku region, and oil is the chief industry of the state. The oil fields are operated according to modern methods and the output in 1929-30 was 10,208,000 metric tons of oil, or nearly 60% of the entire output of the country. Fishing and the weaving of woolen and cotton stuffs are other important industries. The chief mineral products, in addition to oil, are copper and salt.

**BAKU**, the capital, is connected by railway with **TIFLIS**, the capital of Transcaucasia, and with other important cities. The total length of the railroads of Azerbaidjan in 1927 was about 500 mi. Pop. 1930, 2,477,800.

**AZIDES**, the salts of hydrazoic acid,  $N_3H$ , also called azoimides and hydrazoates. Many of the azides are formed by dissolving metals in an aqueous solution of the acid. These metallic salts all crystallize in the anhydrous condition and decompose upon heating. The azides are explosive and readily interact with the alkyl iodides.

**AZILIAN CULTURE**, the first stage of culture of the **MESOLITHIC PERIOD**, the period of transition from the Old Stone Age (see **STONE AGE**) to the New Stone Age. It is represented by discoveries at Le Mas d'Azil, in the department of Ariège, France, north of the Pyrenees. Le Mas d'Azil is a natural bridge or tunnel through which runs the river Arise. There are deposits on both banks, about 25 feet thick. The

Azilian flints continue the Magdalenian style. Harpoons are no longer made of reindeer horn, which is hard throughout, but of stag horn, which has a hard surface and soft interior. Therefore the Azilian harpoons are flat, made of the surface layer of stag horn.

The most notable feature of Azilian art is the presence of pebbles on which patterns are painted with red oxide of iron mixed with resin. These patterns have been shown to be conventionalized human figures, earlier stages of which are found in the caves of Cogul and Alpera in Spain, and are therefore Capsian in origin. Similar pebbles painted to represent human beings were used by the modern Tasmanians. Azilian sites are found in Spain, France, Switzerland and Britain. At this period neither pottery nor domestication of animals was known. See **ARCHAEOLOGY**.

**AZIMUTH**, the angle or arc measured along the horizon, from the south through the west, etc., to that point directly underneath the object. It may be observed, and used, together with the **ALTITUDE** to describe completely the position of an object in the sky at a certain time and seen from a certain place.

**AZO-COMPOUNDS**, organic substances whose general formula may be written  $RN:N\cdot R'$  where  $R$  and  $R'$  are aliphatic (see **ALIPHATIC COMPOUNDS**) or aromatic (see **AROMATIC COMPOUNDS**) basic radicals, such as the methyl, ethyl and phenyl groups. (See **CHEMISTRY, ORGANIC**.) The simplest representatives are, respectively, azo-methane,  $CH_3\cdot N:N\cdot CH_3$ , and azo-benzene,  $C_6H_5\cdot N:N\cdot C_6H_5$ , the latter being prepared by the reduction (by means of nascent hydrogen) of *nitrobenzene* in an alkaline solution, and giving rise to *benzidine* upon still further reduction. The aromatic azo-compounds are by far the more important of the two classes. They are strongly colored, and, although themselves incapable of being used as dyestuffs (see **DYES, SYNTHETIC**), they form the basis of a very large number of valuable azo-dyes, largely amino-azo-compounds. Among these may be mentioned **METHYL ORANGE** or helianthin, which is intensely red in acid solution and yellow in alkaline, and is therefore, used as an indicator (see **INDICATORS, CHEMICAL**).

**AZORES**, a Portuguese archipelago in the Atlantic Ocean, situated between  $37^\circ$  and  $40^\circ$  N. lat., consisting of three groups: the eastern group with São Miguel, the largest island, the middle group with Pico, which reaches 8,000 ft., and the western group with Flores. The total area is 922 sq. mi.; the population of 232,012 has shown a tendency to decline in recent years, many having emigrated to the United States. The area of the different islands is: São Miguel, 299 sq. mi.; Santa Maria, 38 sq. mi.; Terceira, 164 sq. mi.; Graciosa, 24 sq. mi.; São Jorge, 91 sq. mi.; Pico, 173 sq. mi.; Flores (1,176 mi. west of Portugal), 54 sq. mi.; Fayal, 69 sq. mi., and Coroo (about 1,000 mi. east of Newfoundland), 7 sq. mi. The chief towns are Angra, in Terceira; Ponta Delgada, in São Miguel, and Horta, in Fayal.

The soil is fertile and the climate healthy. The

islands lie in the sub-tropical, high-pressure area but are far enough north to be strongly affected by eastward-moving depressions in winter. Destructive earthquakes are occasionally experienced. Temperate cereals, maize, butter, cheese and considerable quantities of wine are produced. Many fruits are grown, but orange cultivation has declined because of disease; the yield of pineapples, however, increases. Local fisheries are important and numerous hot springs occur.

The Azores are administered as an integral part, not a colony, of Portugal, and are considered as belonging to Europe. Cabral, the Portuguese navigator, discovered the islands in 1432.

**AZOTORRHEA.** See PANCREAS.

**AZOV, SEA OF**, a sea south of Russia, connecting with the Black Sea through Kerch Strait. The Gulf of Taganrog forms its northeastern extremity; a narrow western strip is cut off by land to form the Sivash, or Putrid Sea, bordering on the Crimea. The sea's maximum length is about 220 mi., its average breadth 80 mi. and its area is estimated at 14,000 sq. mi., which includes about 40 sq. mi. of islands. Although the Azov is free from ice except during a few winter months, its general shallowness reduces navigation; but since 1924 there has been regular steamer traffic over its waters between the Azov ports and Constantinople, Port Said and other ports. Berdiansk, Yeisk, Taganrog, Mariupol and Genichesk are its chief ports, exporting much wheat. The seashore is low; rocky stretches occur in the southern portion. The water is only slightly saline.

**AZRAEL**, the angel of death who, according to Mohammedan belief, watches over the dying and separates the soul from the body. He is also called Izrail and Malak-el-Maut.



A LESSON IN AZTEC SPINNING  
(FROM THE CODEX MENDOZA)

**AZTEC**, a tribe and linguistic stock of Nahuaspeaking people who dominated the highlands of southern Mexico at the time of the Spanish conquest. The legends of the Aztec indicate that they migrated

south from their home, the island of Azatlan. The location of this island has never been ascertained and it is generally regarded as mythological. The Aztec came into power in the 13th or 14th centuries. Their capital was Tenochtitlan, the present City of Mexico, a city built of stone with elaborate palaces, fountains, baths, gardens, and an extensive canal system. Their government and social life were highly organized. With the exception of the priests every man was a soldier. Records tell of many wars waged solely for plunder and aggrandizement. The Aztec were cannibals and their



AZTEC GIRL BEING TAUGHT TO WEAVE (FROM THE CODEX MENDOZA)

religion was a confused polytheism demanding human sacrifice. Corn was the basis of their economic life. The modern Aztec are a peaceful race. They retain their ancient speech in many dialectic forms, but have lost all semblance of their ancient culture. See also MEXICO.

**AZTEC RUINS**, a national monument containing a group of prehistoric Stone-Age ruins, situated in the San Juan River Valley within a mile of the town of Aztec, northwestern New Mexico. This monument comprises 25.88 acres, presented to the government by the American Museum of Natural History in two gifts on Jan. 24, 1923 and July 2, 1928, and enlarged to its present area on Dec. 19, 1930. The main ruin is a large "E"-shaped structure covering about 4.6 acres and containing some 500 rooms. The entire first story of the building is standing and 24 of the rooms have their original ceilings. Many second-story walls and vestiges of a third-story remain. On one of the levels of excavation potsherds have been found which show that certain periods of the Aztec ruin are contemporary with the ruins of the CHACO CANYON National Monument. In six of the excavated rooms is a museum.

The Monument is easily reached. It is on a branch of the Denver and Rio Grande Western Railroad and also on the New Mexico section of the National Park-to-Park Highway.

**AZURITE**, a beautiful blue, basic carbonate of copper, mined as an ORE of that metal. It is usually found fairly near the surface, where it forms as the result of the change of other copper minerals to the carbonate. Since it is soluble in water, the finest development is attained only in arid regions. Some of the most noteworthy occurrences are in Arizona, the Copper Queen Mine at Bisbee having long been noted for extraordinary deposits of azurite and MALACHITE. Azurite may alter to malachite, the green carbonate, through the loss of some of its carbon dioxide and the addition of water. Alterations to native copper have been observed in New Mexico. Azurite is used for jewelry, ornamental boxes, trays and for inferior grades of paint. See also ORE DEPOSITS; WEATHERING.

**AZUSA**, a city in Los Angeles Co., southern California, on the San Gabriel River, 24 mi. northeast of Los Angeles, served by the Santa Fe Railroad. Citrus fruits are the principal crops of the vicinity. The chief manufactures are sprays, fumigating materials and nitrogen products. Near by are rock and gravel quarries. San Gabriel Cañon is one of the beautiful sights of the vicinity. Founded in 1887, Azusa was incorporated in 1898. Pop. 1920, 2,460; 1930, 4,808.

**AZYMITES**, a term of reproach used by Greek Catholics against the Roman, Armenian, and Maronite churches, where unleavened bread is used in the sacrament. In controversy some Latin dialecticians have retorted by describing their opponents as fermentarians, or prozymites. In the Roman Church, it should be added, the Mass is valid whether the bread is leavened or unleavened.



## B

**BAAL**, a Biblical term of idolatrous significance, variously spelled Bel, Beel or Bal. As a word, it means lord or possessor, and Baal-Berith, lord of covenants. David called a son Beeliada, paraphrased as Eliada, showing that Baal and El were at that time similarly used as names of the Deity. But the Hebrew worship of Jehovah, one God without idol or image, was a complete contrast to the worship of Baal in any form, and especially of the plurality expressed as Baalim, suggesting in Paul's words "gods many and lords many" (I Corinthians 8:5), a vast system of corrupted heathendom, with temples, images, altars, groves, vestments and incense, even on roofs of houses, and worst of all, lascivious rites (*see* BALAAM) and human sacrifices (*see* AHAZ). The merely innocent use of the word *Baal* was abandoned and names themselves were revised. Esh Baal, a son of Saul, became Ishbosheth (II Chronicles 8:33 and II Samuel 2:8) while Jonathan's son Meribael became Mephibosheth (I Chronicles 8:33, II Samuel 4:4), the suffix *bosheth* meaning shame. In Babylon Baal was individualized as Bel (*see* BEL AND THE DRAGON) and thus ranked with Zeus or Jupiter as a major divinity, represented in the skies by a planet. The female counterpart was Ishtar or Astarte. From Tyre the Phoenicians carried Baal westward to Carthage, as is witnessed in names like Hannibal and Hasdrubal. Baal was attended by columns of gold and smaragdus and as he was frequently identified with the Greek Heracles, these appear as the Pillars of Hercules, a picturesque description of the Strait of Gibraltar.

**BAALBEK**, an ancient city of Syria situated on a slope of the Antilebanon about 40 mi. northwest of Damascus. From earliest times Baalbek was the principal center for the worship of Baal as sun god from which both its original and Greek name of Heliopolis are derived. The city was a Roman colony from the time of Augustus Caesar and in the 2nd century A.D. was famous for its oracle. Its buildings are now in ruins, the result of frequent earthquakes and pillaging by Turks, Tatars and Arabs. With the exception of a portion of the wall of the Acropolis which is probably of Phoenician origin, the colossal ruins belong to the late Roman Period. The most famous are those of the Great or Jupiter temple and the smaller temples of Bacchus or Atargatis and of Venus.

**BABBITT, IRVING** (1865- ), American scholar and critic, was born at Dayton, O., Aug. 2, 1865. He was made professor of French literature at Harvard in 1912. Babbitt has given special attention to the romantic movement in literature, art and politics, studying it from the classic point of view. Among his works are *The New Laokoön*, 1910, *Rousseau and Romanticism*, 1919, and *Democracy*

and *Leadership*, 1924. Babbitt is regarded as the leader of a modern "humanism" to which many of the younger critics adhere.

**BABBITT, ISAAC** (1799-1862), American inventor and manufacturer, was born at Taunton, Mass., July 26, 1799. He was a manufacturer of soap and a type of alloy now known as Babbitt metal. This is a fairly soft alloy of tin with antimony and copper. He died at Somerville, Mass., May 26, 1862.

**BABBITT METAL**, a term applied by common usage to comparatively soft alloys used as linings in bearings. First proposed by Isaac Babbitt as an alloy containing 88.9% tin, 7.4% antimony and 3.7% copper. Now practically synonymous with the terms "Anti-friction metals" and "White bearing metal alloys," consisting of both tin and lead alloys, characterized by a conglomerate structure composed of hard particles imbedded in a softer matrix; giving low frictional resistance, sufficient plasticity to conform to irregularities in alignment and running of the shaft, a rubbing surface which tends to hold the lubricating film; avoiding injury to the shaft, and being readily replaceable at comparatively low cost. W.A.C.

**BABEL, TOWER OF**, a lofty structure reaching unto heaven, described in Genesis 11. The name Babel is identical with Babylon and the idea of the tower arose, doubtless, out of the terraced temples, pyramidal in form and prehistoric in date, which were built on the Mesopotamian plain and in which the writer found what seemed a plausible reason for language differences. Significantly, the builders of the tower had brick for stone and slime for mortar, but their languages were confused and they were scattered abroad. Hence is derived the use of the word, *babel*, to mean loud and unintelligible talk.

**BAB-EL-MANDEB**, a strait between Africa and Arabia, uniting the Indian Ocean with the Red Sea and varying in width from 2 to 20 mi. The island of Perim divides the strait into two channels, the western being about 16 mi. across and the eastern about two mi. The greatest depth is 1,100 ft. Navigation through the channels is very dangerous. On the Arabian side is Cape Bab-el-Mandeb and near the African coast there is a group of islands known as the Seven Brothers.

**BABENBERG, HOUSE OF**, a German noble family which for a time had its seat at Babenberg Castle in northern Bavaria, and which ruled Austria from 976 to 1246. Among the earliest known of the Babenbergs was Poppo, count in Grapfeld in the 9th century. One of his sons, Henry (d. 886), became margrave and duke in Franconia, while another, also named Poppo, became margrave in Thuringia. In 892 the younger Poppo was ousted from his possessions by the German king Arnulf, who

assigned the lands to the Conradines, the most hated rivals of the Babenbergers. In the feud which naturally followed, Poppo's three nephews were killed, and the family sank into obscurity. In 976, however, the Emperor Otto II appointed as margrave of Austria one Luitpold or Leopold, count in Donnegau, and a man who is presumed to have been a Babenberg. The Babenberg margraves, later dukes, of Austria, were, on the whole, able administrators and successful fighters. Perhaps the greatest member of the family was Leopold III, the Pious (1096-1136) who, in 1125, refused the emperor's crown, and who was canonized in 1485. It was Leopold V (1177-94) of this line who held Richard the Lion-Hearted of England captive for a time when the latter returned from a crusade. The Babenberg family died out when Frederick the Quarrelsome was killed in battle in 1246. W. C. L.

**BABER** (1483-1530), a conqueror of India and founder of the so-called Mogul Dynasty in India was born in 1483. He was a descendant of GENGHIS KHAN, a great-grandson of TIMUR and the son of Omar Sheik whom he succeeded as king of Ferghana in 1495. He conquered Kashgar, Kunduz, Kandahar, and Kabul and in 1526 Delhi and Agra. In 1527 he completed his conquest of India by a decisive victory over the Rajputs. Baber was an able general and statesman. He instituted many reforms and improvements and encouraged art and science. He himself wrote poetry and a vivid account of his life and conquests called the *Babar-Nama* which has been translated into English. He died December 28, 1530.

**BABEUF, FRANÇOIS NOËL** (1760-97), French Communist, was born at St. Quentin in 1760. At the outbreak of the FRENCH REVOLUTION he was already very radical, setting forth his ideas in a striking work entitled *Cadestre perpetuel* in 1789. In 1794 he founded *La Tribune du Peuple* in which he advocated economic and social equality as well as political equality, and the complete destruction of private property. In the same year, he developed these ideas in greater detail in his study entitled *Du Système de population* (1794). A thoroughgoing radical and agitator, he organized a plot to overthrow the Directory and establish Communism in 1796. The plot was discovered and he was arrested, tried and executed along with his colleague, Darthé, on May 28, 1797.

**BABINE**, an Athapascan Indian tribe, a branch of the Takulli, divided into three groups, the Nataotin, Babine and the Hwotsotenne, all living in seven villages in the environs of Babine Lake, Brit. Col. The name Babine originated with the French Canadians because of the tribal custom of wearing labrets, or lip plugs, also a custom of the Eskimo and the North Pacific Coast Tsimshian. Although ordinarily not considered as belonging in the Northwest Coast culture area, their culture generally has been much influenced by contact with the tribes there.

**BABINGTON PLOT**, a conspiracy organized in 1585 to assassinate Queen Elizabeth of England and place upon the throne Mary Stuart, Queen of Scots.

The plot was developed by Anthony Babington and a Catholic priest, John Ballard, while aid was promised by Philip II of Spain. Babington conducted a long correspondence in code with Mary, unaware that his activities were being followed by spies of the Crown. In Aug. 1586 Ballard was seized. He confessed and with five others was executed for high treason. The subsequent execution of Mary was based upon her connection with Babington.

**BABIRUSSA**, the so-called "horned hog" or masked boar of the East Indies. The single known species (*B. alfurus*) is placed in a genus of its own. This big, bluish, almost hairless pig, inhabiting moist jungles of Celebes and Boru, is distinguished in the male by two pairs of enormously recurved tusks, sometimes a foot long. The lower project at the corners of the mouth; the upper and longer pierce skull and lip at an upward angle near the middle of the face, describe a sweeping curve to a point above the eyes, then turn outward again at the tip. It is assumed that these now useless tusks were serviceable to ancestors of the swine. The animal feeds on fallen fruits. The pork is well-flavored.

**BABISM**, the religion of the followers of the Bab, or "Gate," who prefer to call themselves the "People of Explanation" (Ahl-i-bayan). The Bab in this instance was Ali Mohammed, a Shiite Moslem of Shiraz, Persia, who in 1844 at the age of 23 declared himself to be the gateway to knowledge of divine truth. He had been occupied for some time with religious questions, had practiced austerities (which possibly affected his mind), and had made the pilgrimage to the tomb of the Shiite martyr Husayn, at Kerbala. The Bab denounced the official clergy and aroused the antipathy of the established order in Shiraz and elsewhere. In consequence he suffered imprisonment and, finally, death before a firing squad (July 1850), at Tabriz. His numerous disciples carried on the work after him. A certain Husayn, of the Skaikhi sect, became his first disciple, and in turn won two brothers of Teheran, who were later known as Subh-i-Azal and Baha'u'llah. See BAHAIS.

Under the guise of Islam the Bab announced his own peculiar doctrines with a view to forming a new social order. He legislated in his Bayan on various matters of life and custom. God is one and Ali Mohammed reveals him. God created the world, and mankind owes him reverence. Certain fasts are compulsory, although ablutions are merely recommended. Preaching in mosques is recommended, but prayers are no longer to be offered up in common. Places of pilgrimage include the birthplace of Ali Mohammed, and his prisons. Believers are pledged to pay taxes, but no authority may compel them to pay. Marriage is compulsory. All women may discard the veil and may converse with men. The accumulation of wealth is permitted, and begging is forbidden. Hospitality is enjoined; intoxicating drink is forbidden. J. C. A.

**BIBLIOGRAPHY.**—E. G. Browne, *A Traveller's Narrative*, 1891; *A Year Amongst the Persians*, 1926; and, *The Babi Religion*, 1918.



**BABOON**, the popular name for members of a group of dog-like terrestrial monkeys most of which belong to one genus (*Papio*). With the exception of man they are almost the only primates which have forsaken the trees for the ground. Their appearance is quite unlike that of other monkeys because in becoming adapted to terrestrial life they acquired shorter legs, narrow chests, and a distinctly four-footed walk. They are further distinguished by their long, dog-like muzzles, short tails, and the hairless regions on the buttocks, which, in some forms, are brilliantly colored. They have cheek pouches for temporary storage of food. Most of them are about as large as medium sized or big dogs.

There are some 16 species of baboons, which live nearly all over Africa. One species is found in Arabia. Like many other monkeys they are exceedingly gregarious. Troups, led by an old male, may range in number from 10 to more than 100 individuals. These bands sometimes descend on farms and work havoc on crops. It is said that even lions do not seek encounters with them, for they are fierce and combative. The old males are the most evil tempered of all primates, and their long canine teeth are formidable weapons. They are truly omnivorous feeders, eating indiscriminately reptiles, scorpions, fruit, roots and insects.

In appearance most amazing of all baboons is the **MANDRILL** (*Papio sphinx*). Its fur is olive and silver gray, and the bare skin of its face and buttocks is red and blue.

**BABY-BLUE-EYES** (*Nemophila insignis*), a delicate plant of the water-leaf family, found in moist



FROM JEPSON, MAN. FL. PLANTS CALIF., COPYRIGHT

**BABY-BLUE-EYES**

Plant in flower and scales and section of corolla base

places in California, and cultivated as a border plant. It is a diffuse annual, with divided leaves and beautiful basin-shaped blue flowers.

**BABY BONDS**, bonds of small denomination usually in the sum of \$50 or \$100. Investment in **BONDS** of large denomination requires the concentration of

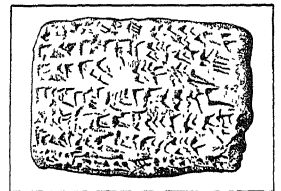
capital of the small investor in a single or perhaps one or two securities; small bonds are issued therefore, to permit increased diversification of investment and as a means of widening the investment market.

**BABYLON**, a celebrated city of antiquity, was situated on the Euphrates River near the site of the modern town of Hillah. The city's origins are lost in obscurity, but its existence has been traced as early as the time of Sargon of Agade, c. 2775 B.C. Toward the end of the 3rd millennium B.C., it was already at the head of a small federation of Mesopotamian city states, and a chief seat of the worship of the Sumerian god, Marduk. Under Hammurabi, 2124-2081 B.C., it was made the capital city of **BABYLONIA**, maintaining that position until the fall of the new Babylonian Empire in 539 B.C. Babylon was strengthened and beautified by Hammurabi and his successors, but was almost completely razed to the ground by Sennacherib, 689 B.C. Its splendor was restored by Essarhaddon, 681-668, Nabopolassar, 625-605, and Nebuchadnezzar, 605-562, under whose reign the city reached its greatest extent and magnificence. Babylon gradually declined in prominence following the Persian conquests, and after the 2nd century B.C. disappeared almost entirely from history.

Herodotus, in his description of Babylon, fixes its circumference at 480 stadia or about 56 mi., but the excavations of Koldewey and others have proven this estimate to be exaggerated. Ancient monuments thus far excavated mostly date from the period of Nebuchadnezzar II and include the famous "Ishtar Gate" with the sacred processional way leading to it, and the great temple of Marduk, *E-sagila*. North of this temple stood the tower of E-temen-anki, commonly identified with the Biblical **TOWER OF BABEL**, now only a cavity known as *Es-sahan*.

**BABYLONIA AND ASSYRIA**. The earliest known inhabitants of Mesopotamia were the Sumerians, a non-Semitic people of uncertain origin. Excavations have shown that they were settled throughout the land before 3500 B.C. Their civilization was highly developed; they were skilled metal workers, possessed a system of writing, dug numerous series of canals for irrigation purposes, and built palaces and tower temples, or ziggurats, of brick. For centuries, the land was divided into a number of city-states, each ruled by a priest king. The most important centers of Sumerian civilization were located in south Mesopotamia, called Sumer, and included Eridu, Nippur, Ur, Lagash (Tello) and Larsa. To the north, Semitic nomads from the west established their own city-states, of which Babylon, Kish and Agade were the most important.

About the middle of the 28th century B.C., a man of Kish named Sargon raised a successful rebellion



COURTESY M. M. OF ART

**BABYLONIAN CLAY TABLET**

and soon won dominion over the northern cities. By subduing Sumer, Elam and North Syria in turn, he extended his sway from the Persian Gulf to the Mediterranean. Sargon founded as his capital the city of Agade, which gave its name to the entire north country. The empire created by him was further widened by his son Naram-sin, but under the Agade rulers who followed, it gradually fell away. Two centuries after Sargon, Sumer and Akkad were conquered by the people of Gutium, who ruled over the land for about 125 years. Then they in turn were overthrown by Sumerians, who established their capital at Ur.

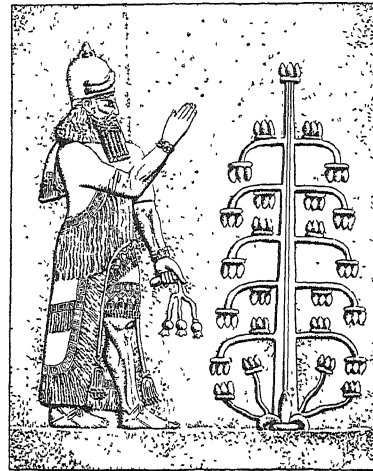
**Semitic Invasions.** The dynasty of Ur endured for more than a century, during which Sumerian civilization experienced an invigorating revival. Its progress was checked, however, by the successful invasions of two foreign groups, both Semitic. From the east came the Elamites who established their dominion over Sumer, while the Amorites pressed in from the west, took possession of Babylon, and ruled the north. About 2100 B.C., a great Amorite king, **HAMMURABI**, made himself master of all Mesopotamia through a series of brilliant victories, and founded the First Babylonian Empire. He codified the laws and customs of the country, reorganized the administration of justice, undertook huge irrigation projects, and consolidated his empire into a mighty unit. Under his beneficent rule, Babylonia experienced great prosperity. Trade, always a dominant feature of Babylonian life, flourished as never before.

After Hammurabi's death, the empire steadily declined, and finally an army of fierce Hittites swept down from the north, sacked the capital city, Babylon, and carried away much of its treasures. Not long afterward, the country was visited by a fresh invasion undertaken by the Kassites, a mountain people from Elam, who seized the throne and set up at Babylon a dynasty which lasted about 577 years, 1746-1169 B.C.

**Invasion by Assyrians.** Meanwhile, in the land northeast of Babylonia, a war-like people, the Assyrians, were steadily gathering power unto themselves. As far back as 3000 B.C., they were already established along the upper Tigris, their chief cities being Assur and Nineveh. Their country had been conquered by Hammurabi, and thereafter his successors regarded it as a vassal state. But in the time of the Kassite kings, the Assyrians were carving out a powerful military empire of their own. They were continually raiding the neighboring states, bringing back plunder and exacting tribute. A great warrior-king, **Shalmaneser I**, 1300 B.C., felt strong enough to declare Assyria's independence of Babylonia. About 200 years later, one of his successors, **Tiglath-pileser I**, extended the Assyrian empire northward to Lake Van and westward to the Mediterranean. He invaded Babylonia and even took Babylon, but failed to establish his dominion there. For several centuries thereafter, Assyria and Babylonia continued their struggle for supremacy with varying fortune.

In 745 B.C., while Assyria was in the throes of

rebellion, one of her generals, **Pulu**, seized the crown and took the name **Tiglath-pileser III**. He lost no time in entering upon a career of conquest, and before he died he had made himself overlord of Syria and Palestine, compelled the Babylonian king to recognize his authority, and so founded a new Assyrian empire. Soon after his death, another general usurped the throne and called himself **Sargon II**. He proved him-



SARGON II BEFORE THE SACRED TREE

self worthy of the name by further strengthening and expanding the already powerful empire; it was probably Sargon who took the "lost ten tribes of Israel" captives to Assyria.

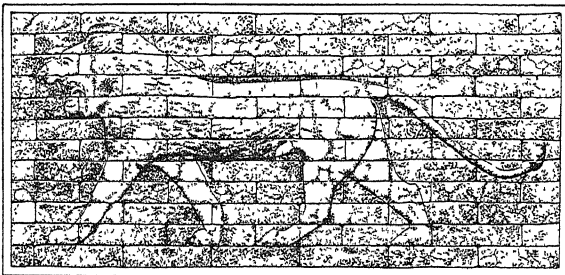
Under his great successors: **Sennacherib**, 705-681 B.C., **Esarhaddon**, 681-668 B.C., and **Assur-bani-pal**, 668-625 B.C., Assyria reached the height of her grandeur and power. She was now undisputed mistress of the Orient; for a time she even ruled Egypt. With the vast wealth that poured into her coffers, Nineveh, the capital city, was beautified; magnificent palaces and imposing temples were erected, and all the arts were encouraged. The reign of **Assur-bani-pal**, who was himself a fine scholar, marked the golden age of Assyrian literature.

**Fall of Assyrian Empire.** But this splendor lasted little more than a century; the very force that was responsible for Assyria's imposing position was destined to bring about her downfall. In order to maintain the large standing army necessary to guard her extensive boundaries, Assyria had permitted the vital arts of agriculture and industry to fall into ruin. Even this huge army proved insufficient to protect the over-expanded empire, and foreign mercenaries had to be called in, a dangerous step which further weakened Assyria. When, therefore, Scythian tribes invaded the country soon after **Assur-bani-pal**'s reign, she had little strength to offer effective resistance. The Scythians ravaged the land and went on to new conquests. In 606 B.C., the last stronghold, Nineveh, fell before a Scythian army aided by Babylonians. With Nineveh's destruction, the Assyrian empire vanished forever.

Free of the Assyrian yoke, Babylonia now once more rose to power. While the Assyrians had been defending themselves against the invaders, Nabopolassar had proclaimed himself king at Babylon, and thus founded the Neo-Babylonian Dynasty. Nabopolassar and his successors managed to restore much of Babylonia's former splendor. His son, NEBUCHAD-NEZZAR II, built a great wall around Babylon, paved the Sacred Way, restored the great temple of Marduk, and created the famous Hanging Gardens, one of the seven wonders of the ancient world. But the new glory of Babylonia was short-lived. In 539 B.C., the country was invaded and conquered by Cyrus of Persia, and thenceforth passed out of history. A. D.E.

**BIBLIOGRAPHY.**—Hugo Winckler, *History of Babylonia and Assyria*, 1907; L. W. King and S. Smith, *History of Babylonia and Assyria*, 3 vols., 1910-28; R. W. Rogers, *History of Babylonia and Assyria*, 2 vols., 1915; *Cambridge Ancient History*, vols. 1-4.

**BABYLONIAN ART.** In spite of the fact that the history of Babylonia extends over thousands of years, few known examples of its art have been handed down to the modern era. Ancient writings describe Babylonian buildings of colossal size and marvelous design. Among these was the great Temple of Baal, perhaps the tower of Babel of Biblical note, which rose in eight graduated stories upon a massive base 600 feet square, surpassing even the pyramids of Egypt. There were also the wonderful walls sur-



COURTESY METROPOLITAN MUSEUM OF ART

TILE PANEL FROM THE PROCESSION STREET, BABYLON, 6TH CENTURY B.C.

Brown earthenware brick enameled in blue, white and yellow

rounding Babylon, and the famous hanging gardens of Semiramis, the latter one of the seven wonders of the ancient world. To-day nothing remains of these glorious monuments but shapeless masses of ruins, marking the place where once stood the seat of a mighty civilization. This state of desolation is explained by the perishable nature of the building materials used in Babylonia. Unlike Egypt, this country possessed little stone and scarcely any wood. The soil, on the other hand, offered clay in abundance, and clay bricks, either sun-dried or baked, became practically the only building material, bitumen serving as mortar. The brick structures afforded scant resistance to the ravages of time, heavy rains and floods.

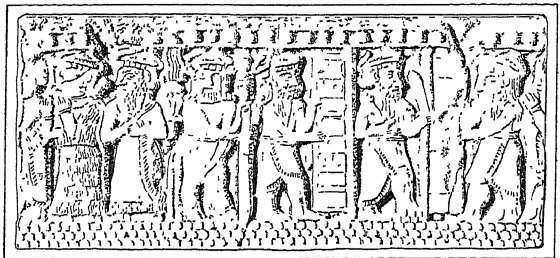
So limited are the remains of Babylonian architecture that restorations are for the most part highly con-

jectural. Temples and palaces were built on immense brick platforms, often of considerable height, which served as protection against floods. In temple architecture, the most prominent and peculiar feature was the "ziggurat," or pyramid-tower of several stages superimposed one upon the other, each stage smaller than the one below, the summit ascended by a ramp. On the top was a shrine of a god. One of the best preserved of these towers is at Ur.

Palaces were massive one-story structures with thick walls and flat roofs, and enclosed numerous chambers, courts and passage-ways. At the main entrances, guarding the approach, were great human-headed, winged bulls and lions.

The arch was known and used in Babylonian architecture since earliest times. Of ornamental details of buildings, little is known except that considerable use was made of enamelled brick.

Among the most important remains of sculpture in the round are several fragmentary statues of black diorite discovered at Tello, in the ruins of the palace of a Prince Gudea (about 2400 B.C.). These display an astonishing craftsmanship. One represents Gudea, headless, in a seated posture, his hands tightly clasped. On his lap he has a surprisingly scientific plan of a fortress. The muscles are strongly modeled, and although, like all Babylonian sculpture, it shows a rigidity and heaviness of form, it possesses strength and a measure of dignity. In the Louvre at Paris may be seen the famous "Vulture" stele of Gudea's grandson, Eannadon, which pictures the latter triumphantly advancing at the head of his army, while the bodies of his vanquished enemies are devoured by vultures. Numerous fragments of bas-relief sculpture



COURTESY METROPOLITAN MUSEUM OF ART

THE SUN GOD EMERGING FROM THE GATES OF THE SUN  
Scene on a Babylonian cylinder of alabaster of about 2500-2000 B.C.

have been unearthed in recent times at Kish and Lagash. These are chiefly representations of military and domestic pursuits. Animals, real and fantastic, are favorite subjects of reliefs.

The Babylonians were skilled in the minor arts, and were especially famous for their weaving. Their engravings on seals and gems were beautifully executed; their walls were covered with glazed and painted tiles. In pottery, jewelry and metal-work they also showed themselves able craftsmen.

**BIBLIOGRAPHY.**—G. Perrot and C. Chipiez, *History of Art in Chaldaea and Assyria*, 2 vols., 1884; L. W. King, *History of Babylonia and Assyria*, 3 vols., 1910-28; C. L. Woolley, *Ur of the Chaldees*, 1929.

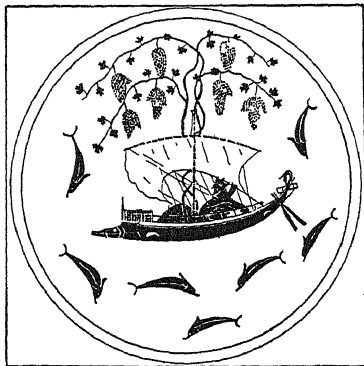
**BABY ORCHID** (*Odontoglossum grande*), a remarkably handsome greenhouse favorite, native to Guatemala. In its habit of growth it is an epiphyte, with lance-shaped leaves, 2 or 3 in number and about 5 in. long, rising from a light-green pseudobulb. The magnificent flowers, brilliant yellow barred with cinnamon-brown, 5 or 6 in. across, and borne on a stout erect stalk, bloom in the autumn.

**BABY'S-BREATH** (*Gypsophila paniculata*), a tall, diffusely branched perennial of the PINK family, native to Europe and northern Asia. It is widely grown as an ornamental plant, especially in rock gardens and borders. The clusters of numerous dainty white flowers are much used as trimming for bouquets. The name is also applied to the wild madder (*Galium Mollugo*), and to the Scotch-mist (*G. sylvaticum*), natives of Europe which have become naturalized in the eastern United States.

**BACCHANALIA**, feasts in honor of **BACCHUS**, the god of wine. They were held both in Greece and Italy, and at first were attended by women only. Later they became debauches in which men joined also. The revelers decked themselves in skins and carried *thyrsi*, or wands, wound with ivy and leaves. They ran drunken through the streets and country, beating drums and crying to Bacchus. In Rome the festivals lasted three days in the year. They became so obscene that the Senate decreed their abolition in 186 B.C. These feasts were also called *Trieterica* because they were held every third year.

**BACCHANTES.** See **BACCHUS**.

**BACCHUS, DIONYSUS or LACCHUS**, in Greek and Roman mythology, the god of wine, the son of Zeus and **SEMELE**, born at Thebes. He was at first looked upon as the god of the cultivation of vines



DIONYSUS IN A BOAT  
Interior of a black-figure kylix (drinking  
cup) by Exekias, in the Berlin Museum

and fruit, but later became associated with drunkenness. His festivals were the **BACCHANALIA**. He is represented with an ivy wreath, thyrsus and kantharos, or two-handled cup.

**BACCHYLIDES** (5th century B.C.), Greek lyric poet, was born at Iulis, Island of Ceos, c. 507 B.C. It is believed that he was a contemporary of **SIMONIDES** and **PINDAR** and that the three poets visited at the

same time the court of Hieron I of Syracuse (478-467). Fragments of Bacchylides's hymns, choral odes, dance songs, drinking songs and elegiacs are extant.

**BACH, JOHANN SEBASTIAN** (1685-1750), German music composer, was born in Eisenach, Mar. 21, 1685. His father, Johann Ambrosius Bach (1645-95), and his grandfather, Christoph Bach (1613-61), were both musicians of distinction. The Bach name, indeed, was virtually synonymous with music in Thuringia, so numerous were Johann Sebastian's musical relatives; however, no other member of the line remotely approached his creative genius, which is generally conceded to be the greatest in the history of music.

Bach's life was devoid of dramatic incident, and outside the field of music is noteworthy chiefly in the fact that he was the father of twenty children. Seven of these were by a cousin, Maria Barbara Bach, whom he married in 1721 soon after the death of his first wife. Of his eleven sons and nine daughters, only six sons and four daughters survived their illustrious parent, while one only achieved eminence. This son was **KARL PHILIPP EMANUEL BACH**. As a boy Johann Sebastian Bach studied the violin with his father and the clavichord with his brother, attending the local schools and obtaining instruction in the organ from Böhm. After playing in various churches and small orchestras, he became court organist at Weimar in 1708, soon afterward making concert tours which attracted increasing attention, due to his remarkable gift for improvisation. In 1717, he became capellmeister to Prince Leopold of Anhalt, a post which offered him a measure of freedom and directed his energies mainly toward chamber music. It was not until 1723, however, when he had reached the age of thirty-eight, that he became cantor of the Thomasschule and organist and musical-director of the Thomaskirche and the Nicolaikirche—duties which gave him ample leisure for expressing his creative talent. His major compositions were created during the next twenty-seven years of his life. Overstrain of his eyes as a youth induced a strain which resulted shortly before his death in complete blindness. Two operations failed to cure him, although his sight was suddenly and partly restored just ten days before he died.

While Bach was esteemed by his contemporaries, his colossal genius was not recognized until more than fifty years after his death, when Mendelssohn began to perform Bach masterpieces that had been permitted to remain almost in oblivion. Since the day of Mendelssohn the nobility of his style and the singular tenderness and purity of Bach's message, no less than the classical finish of his technic, have been universally conceded. His enormous fecundity makes a catalogue of his entire output impossible here, but foremost among his works are his B minor Mass, the St. Matthew and St. John Passion oratorios, the organ preludes and fugues, his orchestral suites and concertos, six sonatas for unaccompanied violin, and his Goldberg Variations and 48 preludes and fugues for

the pianoforte (the latter known as *The Well-Tempered Clavier*). He died at Leipzig, July 28, 1750.

**BIBLIOGRAPHY.**—Philipp Spitta, *Johann Sebastian Bach*, 1873 and 1880; C. H. H. Parry, *Johann Sebastian Bach*, 1909; Rutland Boughton, *Bach*, 1907.

**BACH, KARL PHILIPP EMANUEL** (1714-1788), German musician and composer, son of JOHANN SEBASTIAN BACH, was born at Weimar, Mar. 8, 1714. He studied jurisprudence at Leipzig and at Frankfurt-on-the-Oder, but after graduation decided on a musical career. He obtained an appointment in the service of the crown prince of Prussia, and became a member of the royal household when the prince became king in 1740. He won recognition chiefly for his clavier sonatas. Enjoying the favor of Frederick the Great, he dedicated to him two sets of sonatas. Discriminating musicians regard with high favor his *Sonaten für Kenner und Liebhaber* and his oratorio, *Die Israeliten in der Wüste*. He died at Hamburg, Dec. 14, 1788.

**BACHELLER, IRVING ADDISON** (1859- ), American novelist, born at Pierpont, N.Y., Sept. 26, 1859. He was an editor of the *New York World* from 1898 to 1900 and became a recognized fiction writer upon the publication of *Eben Holden*, 1900. Other well-known works by Bacheller are *Darrel of the Blessed Isles*, 1903, *Silas Strong*, 1906, *A Man for the Ages*, 1919, and *Father Abraham*, 1925.

**BACHELOR'S BUTTON.** See CENTAUREA; CORN FLOWER.

**BACHYA BEN ASHER** (c. 1260-1340), Jewish Cabalist and Biblical exegete, lived at Saragossa, Spain, from about 1260-1340. He was active in spreading the knowledge of mystic piety and beliefs among his coreligionists. Bachya was a disciple of Solomon ibn Adret and a younger contemporary of MOSES NAHMANIDES. He was the first to base his principal work, the commentary on the Pentateuch, on mystical teachings and speculations, usually called *Pardes* in Jewish literature. In preparing this work he thoroughly examined the writings and methods of all the former Biblical exegetes. He accepted the results of philosophical thought as valid only when not in contradiction to tradition and to the Bible. The popularity and importance of this work are indicated by the fact that it was actually translated into Latin.

In addition to several other works Bachya wrote the popular *Kad Hakemah* or *Flour Jar*, first printed at Constantinople in 1515, containing many essays and lectures on religion and morals, also on the most important ritual and ceremonial laws. In this work he endeavored to stress the moral and religious requirements exacted of man, emphasizing strongly the necessity and the duty of practicing righteousness towards all non-Jews, whom he regarded as Israel's brothers.

A. SH.

**BIBLIOGRAPHY.**—Bernstein, *Die Schrifterklärung des Bachja ben Ascher*, 1891; Winter and Wünsche, *Die Jüdische Literatur*, vol. 2, pp. 321, 433-34.

**BACHYA IBN PAKUDA** (11th century), Jewish moral philosopher, philosopher of religion and

rabbi, lived in Spain, probably about the end of the 11th century. Little is known of his life. What Spanish city he dwelt in is not certain, although this is generally assumed to have been Saragossa. In his work, *The Duties of the Heart*, originally written in Arabic in 1040, but best-known in its Hebrew translation, he set up an absolutely new and original moral theology of Judaism. He asserted that the most important mode of life is that man's conduct be guided altogether by consideration for godlike purity of both character and action. He thus labored for the spiritualization of Judaism, declaring that its religious and moral injunctions were infinitely more necessary and important than its ritual and ceremonial laws. He therefore aimed to portray the Jewish religion as a great spiritual truth based on reason; on revelation, the written law, and on tradition, the unwritten or oral law. The only true and worthwhile life, he declared, is the strict moral life, holy, upright, godly and self-denying. For hundreds of years Bachya's *The Duties of the Heart* was extremely popular among the Jews.

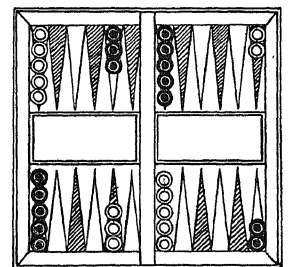
**BIBLIOGRAPHY.**—Husik, *A History of Medieval Jewish Philosophy*, 1916; Graetz, *History of the Jews*, 1926.

**BACILLUS.** See BACTERIA.

**BACK COUNTRY.** See HINTERLAND.

**BACKGAMMON**, probably the oldest and most widely played of dice games. Some authorities trace its origin to Egypt; others believe it was invented in the 10th century. The Roman Twelve Line Game, *Ludus duodecim scriptorum*, resembled backgammon. Chaucer speaks of a game of tables played with three dice, and in England, backgammon was known as tables until the 17th century. The name is said to be Welsh, meaning little battle, although other authorities state that the term comes from the Saxon *bac* and *gamen*, that is, back-game, because under certain conditions a piece may have to go back to the beginning and start over again. Backgammon is called *tric-trac* in France.

The requirements of the game are a backgammon board, 15 pieces or men for each player, a dice box and a pair of dice. The board has 24 points of alternating colors and is divided into four tables. Each player has an inner or home table and an outer table. The inner and outer tables are divided by a raised line called the bar. At the start of the game, the board is set up as in the drawing.



BACKGAMMON BOARD

Each player tries to move all his men around the board into his own inner table and then to bear them off before his opponent can do the same with his. The men are moved from the opponent's inner table to his outer table, then to the player's own outer and finally to his own inner table. A player can move a man as

many points as there are spots on the two dice he throws. He may move a man for each dice or he may take the whole throw for one, making the move in two distinct parts, according to the number of spots on each dice. A man may be moved to any point not already occupied by two or more of the opponent's men. He may not use a point so occupied, even as a temporary resting place in making a double move. Throwing a doublet, both dice the same, doubles the number of points, thus a pair of fives would give 20 points.

When there is but one man on a spot, it becomes a blot. If the opponent can move a man to this spot, the blot is hit and the man removed to the bar. His player may reenter him only by throwing a number corresponding with an unoccupied point in his adversary's home table. While he has a man to reenter, the player can make no other move. When all a player's men are in his home table, he bears off two at a time by throwing numbers to correspond to points on which he has men. Doublets allow him to bear off four men. A hit, or single game is won when a player bears off all his men before the other. A gammon is won when one player bears off all his men before the loser has taken off any. This is a double game. A backgammon is scored when all men are borne off, while the opponent still has a man in the winner's inner table. This is a triple win.

The rules of Russian and Turkish backgammon differ considerably from those of the English game.

See L. Hattersley, *How to Play the New Backgammon*, 1930; or complete edition of *Hoyle's Games*.

**BACKHAUS (BACHUS), WILHELM** (1884- ), German pianist, was born at Leipzig, Mar. 26, 1884. He studied the piano under Alois Reckendorf at the Leipzig Conservatory during 1891-94, and made his debut at Frankfurt in 1899, after completing his studies with Eugen d'Albert. In 1900 he began a series of concert tours, and in 1905, while on the faculty of the Royal College of Music, Manchester, England, he won the Rubinstein prize of 5,000 francs for piano-playing. His first of a series of American concert tours was held during 1912-14. His brilliant execution and musical scholarship have earned him increasing critical favor on both sides of the Atlantic.

**BACON, AUGUSTUS OCTAVIUS** (1839-1914), American legislator, was born in Bryan Co., Ga., Oct. 20, 1839. Soon after his graduation from the law school of the University of Georgia, the Civil War broke out and he enlisted in the Confederate army, and rose to the rank of captain. At the close of the war he entered politics, serving in the Georgia house of representatives for 12 consecutive years, 1871-82. In 1894 he was elected United States senator and was successively re-elected in 1900, 1907 and 1913. He alternated with Senator Gallinger as President pro tempore of the senate after the death of Vice-President Sherman. Bacon died at Washington, D.C., Feb. 14, 1914.

**BACON, FRANCIS** (1561-1626), English philosopher and statesman, was born in London, Jan. 22,

1561. He studied at Trinity College, Cambridge, and was admitted to the bar in 1582. Bacon served continuously in parliament from 1584-1614. Many were the high positions and titles conferred upon him. These included knighthood, 1603; Solicitor General, 1607; Attorney General, 1613; Keeper of the Great Seal, 1617; Lord High Chancellor, 1618; Baron of Verulam, 1618, and Viscount St. Albans, 1620. At the age of 60 he was accused of accepting bribes and fined £40,000. He died Apr. 9, 1626.

Bacon is outstanding for having denounced the learning of his time. Bitterly opposed to scholasticism, he not only set forth a masterful polemic against the traditional learning but made an eloquent appeal for the new knowledge that was beginning to assert itself. Nevertheless it is curious to note that he held himself aloof from some of the most advanced scientific discoveries of his day. An advocate of a new method, he made little headway with its use. Bacon regarded the learning of his time as idle, trivial and contentious. It was sterile in its production of consequences. But before the new learning could be ushered in it was first necessary to get rid of idols that prevented the mind from seeking truth impartially. These he called the idols of the tribe, the cave, the forum, and the theater. "Knowledge is power," but this knowledge must be of things and not mere words. He advised man to go to nature and study nature first-hand. For this reason he is sometimes called the father of the inductive method. Generalization must be based on particulars, and the ideal would include a complete knowledge of the facts. The method is one of comparison and elimination of instances. It is not induction as it is regarded to-day and does not give adequate place for the use of the hypothesis as a means of controlling the situation under investigation.

Second only to Shakespeare, Bacon was one of the most learned men of his time. In fact some of Shakespeare's works have been attributed to him. His main works are: *The Advancement of Learning*, 1605; *Novum Organum*, 1612, and the *New Atlantis*, 1622. The latter is a utopia in which is pictured the state when the new scientific learning has come into its own.

**BACON, HENRY** (1866-1924), American architect, born at Watseka, Illinois, November 28, 1866. He was a member of the firms of McKim, Meade and White, and Brite and Bacon for several years, but established his own office and practice after 1903. Among the many buildings and monuments designed by him were the *Court of the Four Seasons* at the Panama-Pacific Exposition, and the *Lincoln Memorial* at Washington, D.C. He died at New York City, February 16, 1924.

**BACON, ROGER** (c. 1214-94), English philosopher and scientist, born at Ilchester, Somersetshire, 1214. After studying theology at Oxford and Paris, he became a Franciscan monk. He took up residence at Oxford and entered into scientific research, mainly in the fields of physics and alchemy. He invented the magnifying glass, developed a saltpeter



explosive and made discoveries that were of great importance to the science of his time. Because of his scientific accomplishments and his severe criticism of members of the clergy, he was accused of dealing in "black magic" and removed to Paris (1257) and kept from pursuing his work for eight years. During his subsequent period of freedom he wrote his *Opus Majus*, an encyclopedia of science, and other works. In 1278, he was imprisoned by the pope and remained in confinement for ten years. After his release, he returned to Oxford and, in 1292, wrote his *Compendium Studii Theologiae*. In addition to his other scientific work, he discovered errors in the then-existing calendar. The date of his death is not certain, being probably in 1294.

**BACON**, a meat product cut from the sides, belly and breast of hog. It is cured by soaking in brine to which are usually added sugar or molasses for flavor and to counteract the hardening effect of the brine, and saltpeter which acts as a preservative and retains the natural meat color which would be destroyed by salt. After curing, it is smoked, for additional flavor and preservation.

**BACON-SHAKESPEARE CONTROVERSY, THE**, a controversy based on the thesis that the plays generally attributed to Shakespeare were written by FRANCIS BACON. The Baconian theory, which may have been first suggested by Herbert Lawrence in *Life and Adventures of Common Sense*, 1769, depends chiefly upon the improbability that so uneducated a man as Shakespeare could have written the plays and upon the presence in the plays of a cryptogram allegedly pointing to Bacon as the playwright. The evidence was first presented by Joseph C. Hart in *Who Wrote Shakespeare?*, 1852, and was later augmented by N. B. Holmes in *The Authorship of Shakespeare*, 1866-86, Ignatius Donnelly in *The Great Cryptogram*, 1888, Mrs. E. W. Gallup in *The Bi-Lateral Cypher of Francis Bacon*, 1900, Eva Turner Clark in *Hidden Allusions in Shakespeare's Plays*, 1931, and others.

**BACON'S REBELLION**, 1676, an uprising of Virginia colonists, particularly the debtor class and those on the frontier, against the administration of Sir William Berkeley, governor. The immediate grievance was the failure of the governor to protect the frontier from Indian ravages. Berkeley, privately interested in the fur trade, refused to authorize the militia to proceed against the Indians and so hamper that trade. His personal arrogance, the adjournment of the House of Burgesses from 1660-75 at Berkeley's orders, the subservience of the Council to the governor, the adoption of a closed vestry system and of property qualifications for electors of the Assembly, and popular dissatisfaction with the tax levies in amount and distribution, were other causes for the rebellion, which crystallized about Nathaniel Bacon, lawyer and planter, intransigent member of the governor's Council. Bacon was arrested for having led an unauthorized expedition against the Indians. Violating his parole, he was in effect outlawed by proclamation

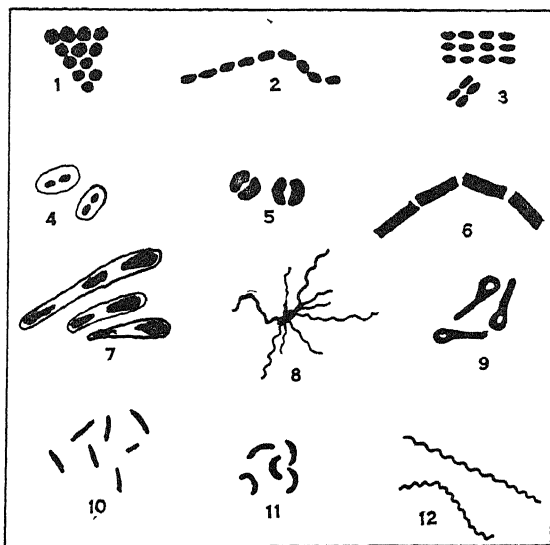
of the governor. Marching upon Jamestown with 600 men, Bacon overawed Berkeley, secured a commission as major-general of militia, and set out upon a second Indian campaign. Meanwhile Berkeley attempted to raise a force against Bacon. Returning from his triumph against the Indians, Bacon captured and razed Jamestown, Sept. 19. The sudden death of the leader of the rebellion on Oct. 26, probably from malaria, precipitated the collapse of the movement. Berkeley, again in power, virulently persecuted the rebels, executing 23, and ceasing his persecutions only when commissioners from Charles II arrived in Virginia.

**BACTERIA**, microscopic single-celled organisms. The study of bacteria is known as Bacteriology.

The bacterial cell consists essentially of protoplasmic material held by a semi-permeable membrane. There is no visible nucleus. In some species a capsule surrounds the cell membrane. Organs of locomotion, called flagella, are present in certain types, and are extremely fragile thread-like organs. Some bacteria form resting spores which may remain alive under adverse conditions.

Bacteria are generally classed as plants, but actually there is no sharp line of distinction between the lower fungi (yeasts and molds) and the bacteria or between the latter and the lowest forms of animal life.

There are three general types of bacterial cells. The spherical, known as cocci, the rod-shaped cells or



KINDS OF BACTERIA

1, *Staphylococcus*; 2, *streptococcus*; 3, *sarcina*, 4, *pneumococcus*; 5, *gonococcus*; 6, *Bacillus anthracis*; 7, *B. diphtheriae*; 8, *B. typhosus*; 9, *B. tetani*; 10, *B. tuberculosis*; 11, *Spirillum cholerae*; 12, *Treponema pallidum*

bacilli and the spiral forms known as spirilla. The size of the cell varies greatly with the different species. Some of the cocci have a diameter of as little as 0.5 micron (one micron equals approximately 1/25,000 of an inch), bacilli vary from one to ten microns in length, while spirilla may be 30 to 40 microns long.

The life cycle of a single cell is short, maturity being reached in from 20 to 30 minutes. Bacterial cells multiply most commonly by elongation of the cell and segmentation into two cells. During the multiplication of the cocci, cell division in certain varieties may take place in the same plane, giving a twisted chain or wreath-like appearance (*streptococci*); others may divide in two planes at right angles, giving the appearance of a cluster of grapes (*staphylococci*); or still others may divide in three planes (*sarcina*). There is no evidence of sexuality.

Bacteria are found in the air, in the soil, in water, in milk, on and in the animal body. In fact, they are ubiquitous. However, certain conditions are necessary in order that the cells may multiply. These conditions vary considerably with the different species. Moisture is always a necessity, although drying does not immediately kill most forms. Strong sugar or salt solutions will not permit bacterial growth, while the same is true of pure distilled water.

Temperature is an exceedingly important factor. While a few species will develop slowly in a refrigerator, most of them grow best between 68° and 104° F. The temperature for optimum growth depends upon the environment in which the cells have been living. Some bacteria will develop at 149° F. or even higher. Very low temperatures do not kill the cells, but they may be broken if frozen in crystals of ice. The temperature at which bacteria die is dependent upon the presence of moisture, being lower when they are moist. Spores, however, are very resistant to extreme heat.

Air is necessary for the growth of certain species. Others will grow in an oxygen tension considerably less than that of the air. Bacteria which require air or oxygen for their growth are called *aërobic* bacteria. Those which can live away from air or oxygen are called *anaërobic*. In general, bacteria need proteins or their derivatives, carbohydrates, and mineral salts. The medium most commonly used in the laboratory for growing bacteria consists of a meat broth containing common salt and peptone. Gelatin, and agar-agar, a seaweed, are used to produce a jelly-like medium.

Direct sunlight has a germicidal action dependent on the intensity of the shorter wave lengths of the light composing it. Certain chemical compounds destroy bacteria. These are known as *DISINFECTANTS* and *ANTISEPTICS*.

The products of bacterial growth may be light (phosphorescent organisms in sea water), heat, pigments and enzymes, which latter are responsible for the ability of bacteria to digest proteins, ferment carbohydrates, or cause other chemical reactions to take place. A few species are known to produce poisons or toxins, which may be the cause of disease.

A number of species of bacteria are harmful to man and animals in that they are directly responsible for disease. Some examples of human diseases known to be caused by bacteria are tuberculosis, pneumonia, diphtheria, typhoid fever, and tetanus (lock jaw).

On the other hand some bacteria are of great economic importance. They are concerned with the decay of animal and vegetable matter and the transformation of this matter into plant food. Bacteria are used in the industries to sour milk, make artificial buttermilks, regulate the texture and flavor of butter, ripen some cheeses and make vinegar from alcohol. On the other hand, foods spoil because of the presence and growth of microorganisms (*see* *FOOD POISONING*).

Bacteria were discovered when the microscope was invented, about 1680, and the study of them has been dependent upon the development of the microscope, the use of colors for staining (and thus differentiating) the organisms, and the preparation of solid media by Koch. By means of silica, gelatin or agar-agar, a medium or substance for growing bacteria can be rendered sufficiently solid so that the cells remain fixed at the point of inoculation. In this way aggregates of bacteria, called colonies, are obtained. These colonies are visible to the eye and, when they consist of only one bacterial species, are known as pure cultures.

The greatest impetus to the study of bacteria was provided by Pasteur. As a result of the interest created by his pioneer work, medical bacteriology has since made rapid strides. *See also* *ANTISEPTICS*; *ANTITOXIN*; *IMMUNITY*.  
J. F. N.

**BADAJOS**, a city of Spain, capital of Badajoz province and an important fortress near the Portuguese frontier. It is the seat of the captain-general of Estramadura, and of a bishop. There is a 13th century, fortress-like cathedral, an old citadel and a museum. Originally a Roman settlement, Badajoz became Moorish in 930. It was the capital of the Aftasides at intervals during the 11th and 12th centuries and was captured finally by the Spaniards in the early part of the 13th century. It was taken by the French in 1811 in the *PENINSULAR WAR*, and captured by the British a year later. Badajoz has manufactures of hats, leather, faience, linen and woolen goods, and engages in cattle breeding. Est. pop. 1929, 40,000.

**BADEN**, a republic of southwestern Germany between Switzerland on the south, Hohenzollern and Wurtemberg on the east, Bavaria and Hesse on the north and the Bavarian Palatinate and Alsace on the west. On the south and west, the Rhine is the boundary. With an area of 5,819 sq. mi., Baden is the fourth largest German state.

Its long and narrow territory embraces great diversity, the Upper Rhenish plain, the highlands in the east, part of the Jura Mountains in the south, the western regions of Lake Constance and four-fifths of the Black Forest, in which it reaches its maximum altitude. The Rhine drains most of Baden. Besides Lake Constance, with its Baden islands, there are also several small but beautiful lakes. *MANNHEIM*, *KARLSRUHE* and *FREIBURG* are among the chief cities.

The climate varies greatly according to altitude and exposure. Baden is poor in minerals, but nevertheless has developed an industry of high grade products, aided by excellent water transportation and the

increasing use of water power. In 1918 Baden became a democratic republic. Among the population, 2,312,462 in 1925, 910,324 were Protestant; 1,350,479, Catholic, and 24,064, Jewish. Of the 1,271,400 gainfully occupied 36.8% are engaged in agriculture and 38.9% in industry and trades.

**BADEN**, in Austria, a watering-place among the foothills of the Vienna woods, visited annually by over 50,000 guests, largely from Vienna. There are 13 radio-active springs, hot and cold, with beautifully laid out promenades, particularly those in the Helenental. Picturesque ruins and handsome villas dot the hills. The baths were completely destroyed by the Hungarians and later by the Turks, but have been restored. Pop. 1925, 25,692.

**BADEN-POWELL, SIR ROBERT STEPHENSON SMYTH** (1857- ), first baron of Gilwell, British soldier, author and organizer of the Boy Scouts, was born in London on Feb. 22, 1857. He was the sixth son of Prof. Baden-Powell of Oxford, and was educated at Charterhouse. In 1876 he joined the 13th Hussars as an adjutant, and served in Indian Afghanistan and South Africa. He commanded the native levies in Ashanti in 1875, and was chief staff officer in the Matabeleland campaign, 1896-97. After his defense of Mafeking, 1899-1900, he was promoted to the rank of major general, in 1908 became a lieutenant general, and retired from the army in 1910.

In 1908 he organized the Boy Scouts, and in 1910, in cooperation with his sister Agnes Baden-Powell, founded the Girl Guides. In 1922 a baronetcy was conferred upon him, and in 1929 he was raised to the peerage as Baron Baden-Powell of Gilwell. His published works include *The Matabele Campaign*, 1899; *My Adventures as a Spy*, 1915, and many books for scouts.

**BADGER**, a carnivorous animal of which there are several species scattered over the Northern Hemisphere, the American badger being *Taxidea americana*. The body is from 25 to 30 in. long, and tail about 8 in. The fur is usually gray on the back and much darker, sometimes even black, underneath, the light



AMERICAN BADGER

head being marked with a black stripe on each side. From this stripe or "badge" the name is supposedly derived. The badger is a shy, solitary, nocturnal animal, living in a burrow. It feeds on fruits, berries, small animals, frogs and insects. A peculiar feature of all badgers is a jaw so formed that it has an almost unbreakable grip. Because of this and the animal's courage, baiting badgers with dogs was a popular sport until prohibited in the 19th century. Badger

hair is used for shaving and other good brushes, and the fur for trimming garments. The long white hairs are sometimes employed to point dyed fox skins in imitation of the silver fox.

**BADLANDS**, a term applied in the western United States to barren uplands so intricately channeled and sculptured by erosion as to present a well-nigh impassable surface. "Badlands" renders literally the French-Canadian trapper's name for this broken country—*mauvaises terres*.

Badlands topography results when relatively soft, loose strata of unequal resistance are dissected by the periodic torrential rains of a generally arid region, where no deep-rooted vegetation anchors the soil. Such lands are not essentially infertile. The rapid run-off, following cloudbursts, strips rugged slopes of surface soil, under-mining such plants as may be struggling for a foothold.

Typical badlands occupy scores of square miles in the Black Hills region of Wyoming and South Dakota, occurring also in Arizona, Nebraska, Colorado, New Mexico, and Texas. Here heavy erosion produces a landscape of fantastic irregularity, a maze of dry intersecting gullies, abrupt BUTTES, fluted slopes, and isolated pinnacles, some brilliantly banded with varicolored clays.

**BADMINTON**, a game played with rackets and feathered shuttles, was derived from the 14th century game of battledore and shuttlecock. It is popular chiefly in England, though it has a small following in New York and Boston. The game is played usually on an indoor court, 44 feet long and 20 feet wide, across the center of which is stretched a net 30 inches deep, elevated 5 feet from the floor. As in lawn tennis, both sides of the court are divided into service courts. Singles and doubles may be played. The badminton bat is racket shaped, weighing about 5 ounces, and is strung with gut. The shuttlecock, carrying from 10 to 15 feathers about 2½ inches long, weighs approximately 85 grains. The object is to keep the shuttlecock in the air, within the confines of the two courts. A foul, that is, not returning the shuttlecock, knocking it out of bounds, or into the net, is an ace for the opposing side. A singles or doubles game is generally won when one side wins 15 aces. The rubber is the best out of three games.

**BAEDECKER, KARL** (1801-59), German publisher, was born at Essen Nov. 3, 1801. In 1839 he began to publish detailed guide books for travellers that now cover practically every civilized country of the world, and that have been published in several languages. He died at Coblenz, Germany, Oct. 4, 1859.

**BAEKELAND, LEO HENDRIK** (1863- ), American inventor and chemist, was born in Ghent, Belgium. He went to America in 1889, founded the Napera Chemical Co., for the manufacture of photographic material in 1893 and gave his name to the bakelite products. His invention of phenol resinoids (synthetic super-resins) has affected all phases of electrical insulation.

**BAEL FRUIT**, an oriental fruit allied to the orange. It is borne on a small tree (*Aegle Marmelos*) of the rue family, wild in northern India and extensively cultivated in tropical Asia. The tree, sometimes beset with rugged spines, bears trifoliate leaves that fall each season and white highly fragrant flowers. The yellowish pear-shaped or globular fruit, sometimes 6 in. in diameter, with a sweet aromatic pulp, is surrounded by a thin hard rind. By the Hindus bael fruit is ranked as one of the most delicious of the citrous group. Sacred to Siva, the tree is commonly planted in temple gardens.

**BAEYER, JOHANN FRIEDRICH WILHELM ADOLPH VON** (1835-1917), German chemist, was born at Berlin, Oct. 31, 1835, the son of a Prussian general and geometer, Johann Jakob Baeyer. He is the discoverer of cerulein, eosin and indol. He was appointed professor of chemistry at Strasbourg in 1872, and in 1875 of the University of Munich, and did much research to establish the nature of indigo for which he received the Davy medal in London in 1881. Baeyer received the Nobel prize for his research in chemistry in 1905. He died at Munich, Sept. 5, 1917.

**BAFFIN, WILLIAM** (c. 1584-1622), English explorer and navigator, was born about 1584. In 1615 he was pilot of the *Discovery* despatched to North America by the Muscovy Company in search of the northwest passage to India. Baffin Bay, discovered on this expedition, was named after him. The data on the region around Baffin Bay which he carefully compiled was valuable to later explorers. Between 1617 and 1622 he made scientific observations on the Red Sea and the Persian Gulf. He died on the island of Kishm, Jan. 23, 1622.

**BAFFIN BAY**, a large gulf in the northeastern part of North America, situated within the Arctic Circle between 68° and 78° N. lat. and 52° and 80° W. long. It is bounded on the east by Greenland and on the west by Baffin Land and islands belonging to the Franklin district of Northwest Territories. To the south Davis Strait connects it with the Atlantic Ocean, and to the north Smith Sound establishes communication with the Arctic Ocean. Its length from southeast to northwest is about 950 mi. and its greatest breadth nearly 400 mi., giving the surface an area of approximately 200,000 sq. mi. The bottom is uneven, varying from 1,200 to 6,300 ft. below the level of the water.

This bay is largely an ice sea and in the winter time is practically a solid mass of icebergs. In the spring and summer the middle pack disrupts sufficiently to permit a brief period of fairly safe navigation. Whales, seals and polar bears abound here. The coast is composed of precipitous rocks rising occasionally to 1,000 ft. and in many places cut into conical shapes so artificial in form that they are called monuments. Both shores are indented with numerous sounds, creeks and inlets. William Baffin first explored the bay in 1616 and gave it his name.

**BAFFIN ISLAND**, an arctic island situated near the mouth of Hudson Bay, with Baffin Bay to the

north. It belongs politically to the Franklin district of Northwest Territories, Canada. The island is a waste region of about 236,000 sq. mi. and is uninhabited except for a few Eskimos on the east coast.

**BAGDAD RAILWAY.** The Bagdad railway in western Asia, an enterprise of international significance, though essentially German in its origin, signifies generally the whole line from the Bosphorus via Bagdad to the Persian Gulf, which was to be an integral part of a still greater system, the B.-B.-B., Berlin-Bosphorus-Bagdad. The line, formed of several independent systems, begins with the Anatolian railway, which was completed in 1896, at Haidar Pasha on the Bosphorus, and connects with the first section of the Bagdad Railway proper at Konia. This section, completed in 1904, extends through the Taurus range by way of the valley of the Euphrates to Eregli. Thence the railway runs eastward to Muslemiye, a place just north of Aleppo, where it joins the Syrian system, which, when completed, will link it to Shergat in Iraq. From there the railway continues to Bagdad, then to Basra on the Persian Gulf. The section from Bagdad to Basra was completed in 1920.

The concession for the Bagdad railway, a project bound up with the future control of large parts of Asia Minor, of Mesopotamia, and of the Persian Gulf, was secured by Germany from Turkey in the convention of Jan. 16, 1902, which, as revised on Mar. 5, 1903, formed the charter of the enterprise. Germany at that time already controlled the Anatolian railway. The enterprise, because of its strategic and economic importance, was considered to be a menace to Russian, French and English interests, particularly to those of England, for it would constitute a new "road to the East." The railway was to be financed by the Deutsche Bank and the Ottoman Bank, with the participation of foreign capital, which was not forthcoming. Though arrangements eliminating the opposition to the project were completed by Germany with Russia in 1911, and with France and England on June 15, 1914, the conflict of ambitions, which the railway aroused, made it a contributing factor in bringing on the World War. After the war the railway practically fell into three parts: the Turkish, within modern Turkey, the Syrian, within the French mandated territory, and the section within the Kingdom of Iraq.

E. M. Mead, *Turkey, the Great Powers, and the Bagdad Railway*, 1923.

**BAGHDAD**, also **BAGDAD**, the capital of Iraq, located on the Tigris River about 350 mi. from the Persian Gulf. Old Baghdad on the west of the river is connected to new Baghdad on the east by a pontoon bridge. The city of *Arabian Nights* fame was founded by the caliph, Al-Mansur, in 762, and for 500 years was the capital of the Moslem world and a center of Arabic art and learning. The Mongols abolished the caliphate of Baghdad in 1258 and the city gradually declined. For decades it was the scene of strife between the Persians and Turks. Finally,

it was captured by Sultan Murad IV and retained by Turkey until the conclusion of the World War, when it became capital of the new Arab kingdom, Iraq.

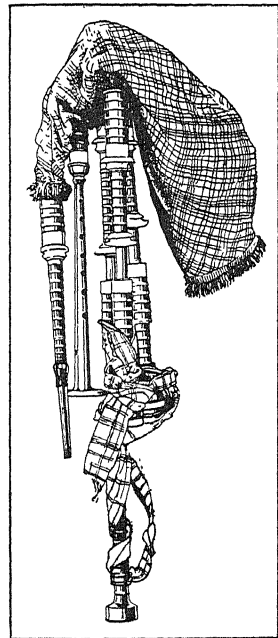
The city has for centuries been the meeting place of caravan routes from Syria and Arabia on the one hand and Persia on the other. Apart from its fame as a mart, Baghdad manufactures silk, woolens, cottons, rugs, pottery and other products.

Baghdad has received many improvements in recent years; new roads have been constructed, sanitation methods have been introduced and up-to-date hotels and a modern hospital have been built. Such modern conveniences as telephones have also been provided. A museum, founded since the World War, has a collection of relics of Mesopotamia. Est. pop. 1928, 300,000.

**BAGPIPE**, an ancient reed wind-instrument, used extensively throughout medieval Europe and still popular in Scotland and Ireland. The "bag" is a leather

wind reservoir to which are connected two or three drone pipes, used for accompaniment, and a "chanter," or pipe, fitted with 68 finger-holes upon which the performer plays the melody.

**BAG PUNCHING**, the exercise of striking an inflated bag with the fists and elbows, designed to develop the arm and shoulder muscles. The standard punching-bag is a pear-shaped leather case, 14 inches in depth, containing an inflated rubber bladder. The bag is suspended from a square board, or a low ceiling, by a swivel socket mechanism, which permits the bag to swing in any direction. The bag bounds back when it strikes the board. Some gymnasiums



COURTESY M. M. OF ART  
SCOTCH BAGPIPE

are equipped with a double-ender, an oval-shaped punching-bag suspended between two lines, one to the floor and the other attached to the ceiling. The tension on the lines pulls the bag back to the striker. Bag punching is widely practiced by boxers, as in addition to developing the muscles, the exercise tends to coordinate speed, timing and accuracy of aim.

**BAG-WORM**, a lepidopterous insect of the family *Psychidae*, common throughout the United States. The larva spins a silken bag about itself, attaches bits of twigs lengthwise to its outer surface and moves with it hanging downward. The bag enlarges as the insect grows, and is finally fastened by one end to a twig, where the caterpillar transforms to a pupa. The female, a wingless, grub-like

creature, lays her eggs here and dies, but the male acquires wings and flies away. Bag-worms often swarm in parks and eat the foliage from the trees unless the cocoons are collected and destroyed.

**BAHAIS**, members of a religious sect tracing connection with the Persian "Bab" but originating particularly with Baha'u'llah, one of two brothers of Teheran, who were disciples of the "Bab." Mirza Husayn Ali, known as "Baha'u'llah," or Splendor of Allah, was born in 1817, became a Babi soon after 1844, and after the Bab's death claimed to be his true successor. Baha'u'llah suffered the displeasure of the Persian Government and lived in exile in Baghdad, Constantinople, Adrianople and Akka until 1892. Jealousy and contention arose between him and his brother, Mirza Yahya (subh-i-Azal), and the movement split in two, both parties since carrying on their propaganda in the West. After the death (1892) of Baha'u'llah, his son Abbas Efendi, "Abdu'l-Baha," assumed the leadership, and after him, Shogi Efendi. Akka has continued the headquarters of the prevailing sect. Propaganda has been carried on in America, aided by books and magazines, and numerous congregations have been established. A pretentious temple was planned as the glorious symbol of the faith, but as yet only the pathetic foundations exist in Wilmette, Ill., roofed over for the conduct of worship. Bahai literature in America bears only remote relationship to the Babi scripture, the Bayan. The Bahais have their own scripture from Baha'u'llah, *Kitab-i-aqdas*, "most holy books." Bahaism is fundamentally Shiite Moslem mahdism (see MAHDI), with admixtures of Christian and idealistic elements for theology and morals. Its claims with reference to a total membership of several millions may be discounted as exaggeration; there are no statistics on them. J. C. A.

See E. G. Browne, *Materials for the Study of the Babi Religion*, 1918.

**BAHAMAS**, a group of about 700 islands and rocks of the British West Indies lying in a series northeast of Cuba and off the southeastern coast of Florida. The total area is 4,400 sq. mi. and the principal islands of the group are New Providence, Abaco, Harbor Island, Grand Bahama, Cat Island, Long Island, Mayaguana, Eleuthera, Exuma, Watling's Island, Acklins, Crooked Island, Great Inagua and Andros. Except for about 20 of the islands, the group is uninhabited, consisting of large rocks, mostly of flat appearance. Sponge, sisal, lumber, tomatoes and shells are the staple products of the group. The imports include spirits and wines, oils, iron and steel manufactures and cotton textiles. The Bahamas are under the control of an appointed governor and a military commander, working in conjunction with two councils and a representative assembly of 29 members who must be property owners. NASSAU, in New Providence Island, is the capital of the colony. Pop. 1931, 59,828.

**History.** At least one of the Bahama islands was sighted by Columbus in October, 1492. Afterward, the Spaniards removed the native population to work

on the larger islands, and the Bahamas, discovered and explored by Spanish navigators, remained abandoned by all but pirates until 1629, when a British company settled New Providence Island. In 1670 the islands were granted for a brief period to the Carolina proprietors, and from 1684 to 1703 were variously occupied by the French and Spanish. In 1717 the local proprietary government was abolished and with but two brief interruptions the group has remained an untroubled crown colony ever since. The Americans occupied New Providence Island in 1776 and the Spanish the same island in 1781, but both shortly withdrew. At the close of the American Revolution many loyalist settlers came over from the continent. During the 19th century the islands were a base of operations for ships carrying slaves from Africa before the Civil War, and for ships running the blockade of Southern ports during the Civil War. Since the passing of the Prohibition laws in the United States, the islands have been a base for rum-runners, operating off the southern seaboard. In the last two decades they have become popular as resorts for the leisure classes, Nassau being the center of the winter resort colony.

**BAHIA.** See SAO SALVADOR.

**BAHIA BLANCA**, a city of Argentina, situated on the east coast, about  $2\frac{1}{2}$  mi. from Bahia Blanca Bay. It is a naval base, an important shipping point for the national territories of La Pampa and Neuquen, and ranks close to Buenos Aires in its activities. It has extensive shipyards and one of the largest dry docks in South America. The chief industry of the surrounding district is sheep and cattle-raising, and wheat is the main product. Est. pop. 1930, 100,000.

**BAHRAIN ISLANDS**, a Persian archipelago lying 20 mi. from the Arabian coast located in the Persian Gulf. Great Britain has jurisdiction over them. The largest island is Bahrain. Other important islands are Maharaq, Sitra and Nebi Saleh. The surface is barely above sea level. The highest land in the center of Bahrain is only 400 ft. above the water. Bahrain island is the center of the pearl fishing industry of the Persian Gulf. Throughout the summer some 15,000 divers are engaged in this enterprise. Besides pearls, coffee, sugar, rice, wheat and flour are exported. Manama, with a population of 25,000, is the capital and Maharaq the chief city. Population of the archipelago estimated at 120,000.

**BAHR-EL-GHAZAL**, a river in northeastern Africa, rising in the Bahr-el-Ghazal region of Sudan, and a tributary of the upper Nile or White Nile. The floating vegetation, or *sudd*, of the Nile is brought down mainly by the Bahr-el-Ghazal from the extensive swamps through which it passes.

**BAIAE**, an ancient city of Campania in Italy, situated on the Gulf of Puteoli near the modern Naples. Caesar, Pompey and Crassus formed their triumvirate here in 60 B.C. Tiberius died in 37 B.C. in Baiae at a villa originally owned by Marius. The Emperor Hadrian also died in Baiae. Because of its mild climate, sulphur springs and rich vegetation, the city

was a popular resort of the Romans. Julius Caesar and Nero also had villas here, and Alexander Severus built one for his mother. Noticeable among its ruins are three domed buildings called temples, but probably baths. In the Middle Ages the locality was infested with malaria and deserted, and most of the site is now covered by the sea.

**BAIKAL, LAKE**, the largest lake of Asia, extending from  $51^{\circ} 28'$  to  $55^{\circ} 30'$  N. lat. and  $103^{\circ} 40'$  to  $110^{\circ}$  E. long. Somewhat resembling a scythe in shape, it occupies a rift valley with mountainous walls in the south of Siberia, is 360 mi. long by 30 mi. wide, and has an area of 13,500 sq. mi. There are hot springs along the eastern shore. Salmon, sturgeon and other fisheries are important, and freshwater seals, in appearance exactly resembling the Spitzbergen *Phoca foetida*, are a source of income to the settlers.

Baikal, the *Dalai-nor* or Holy Sea of the Mongolians, seems to have been much more extensive in former times. Its waters, remarkable for their transparency, are frozen from December to May. In summer communication along the shores of the lake is kept open by a steamer, affording an opportunity to visit the lovely island of Olkhon, famous for its Alpine roses. The northwest has some beautiful scenery, the rocky granite masses in many places here being clothed with larch and pine forests from their summits to the water's edge.

**BAIL.** In law this word is used both as a verb and as a noun. When used as a verb it means the procuring of the release of a person from custody of the law by undertaking that he shall appear at a time and place fixed and submit to the jurisdiction or the judgment or order of the court. As a noun it is used to refer to the sureties who become responsible for the appearance of a person in custody as set forth above. At common law the superior courts have an unlimited power of admitting to bail existing from the earliest times. There is a great variety of constitutional limitation, legislation and regulation in the several states. As a general proposition all but a few grave offenses are bailable as a matter of right, and all others in the discretion of the court. But local constitutions and statutes must be consulted on this point.

**BAILEY, GUY WINFRED** (1876- ), American educator, was born at Hardwick, Vt., May 7, 1876. He was graduated from the University of Vermont, 1900, and studied at Middlebury College and Norwich University. He was admitted to the bar in 1904, and served in the state legislature from 1904 to 1917. He became comptroller of the University of Vermont in 1917 and president in 1920.

**BAILEY, LIBERTY HYDE** (1858- ), American botanist and horticulturist, was born at South Haven, Mich., Mar. 15, 1858. He was brought up on a farm, graduated from Michigan State Agricultural College in 1882 and then studied botany under Asa Gray at Harvard. After serving as professor of horticulture in Michigan State Agricultural College from 1885 to 1888, he became professor of horticulture in Cornell



University in which from 1903 to 1913 he was dean and director of the agricultural college. As a teacher, writer and editor he achieved leading rank as a botanical educator and notably promoted the advance of American horticulture. He edited various important works including *The Cyclopedia of American Agriculture* and *The Standard Cyclopedia of Horticulture*. In addition to contributions to magazines and scientific journals, he wrote numerous works among which are *Plant Breeding*, *Principles of Fruit-Growing*, *Manual of Gardening*, *Nursery Manual*, *Manual of Cultivated Plants* and (with Ethel Zoe Bailey) *Hortus*.

**BAILLIE, JOANNA** (1762-1851), Scottish poet and dramatist, was born Sept. 11, 1762, at Bothwell, Lanarkshire. Her *Fugitive Verses* was published anonymously in 1790. The nine "plays of the passions," in which the principal theme is the influence of a dominating emotion, show keen observation and a vigorous style. Joanna Baillie died Feb. 23, 1851.

**BAILMENT**, in law, the relation created through the transfer of the possession of goods or chattels, by a person called the bailor to a person called the bailee, without a transfer of ownership, for the accomplishment of a certain purpose, whereupon the goods are to be dealt with as instructed by the bailor.

From this definition it will be seen that the distinctive feature of the bailment is a delivery of personal property (the analogue of the bailment in the field of real property is the lease) without a transfer of ownership; while in a sale, title must pass and it is immaterial whether or not there is also a transfer of possession. This idea is reflected in the old definitions of bailment as "possession of a chattel lawfully severed from its ownership" and "goods that a man hath in his keeping which be not his own." The name bailment, too, is derived from the Norman-French word "bailleur," meaning to deliver. The common carrier of goods is doubtless the most important bailee; the warehouseman is also a bailee, as is the pledgee.

Historically, the bailment is very ancient; necessarily, it must have been more or less frequent even in the remote ages of the first faint stirrings of organized society. Thus, we find provisions as to bailments in the Babylonian Code of Hammurabi, in the earliest of the Mosaic Codes, while the Roman Law abounded with principles on the subject. Yet in English jurisprudence, the subject was very slow in developing. The opinion of Lord Holt in *Coggs v. Bernard* (1703), 2 Ld. Raym. (Eng.) 909, was the first important effort to set the English law of bailments in order; while the first book of real consequences in this field was the work of Sir William Jones in 1781. No American book of note appeared on this subject until the treatise of Justice Story in 1832.

There are many legal incidents, rules and principles applicable to all bailments. Among the more important of these are the estoppel of the bailee to deny the title of the bailor, the fact that in an overwhelming majority of instances (though not necessarily) the bailment is created by express contract, and

that certain events, such as destruction of the bailed goods, necessarily terminate all bailments.

Usually, however, in practice, these legal incidents cannot be worked out until the bailment is classified. The standard classification, on the score of the person receiving the benefit from the bailment, divides bailments into three classes: (1) bailments for the sole benefit of the bailor; (2) bailments for the sole benefit of the bailee; (3) bailments for the mutual benefit of both bailor and bailee.

A. M. D.

**BAILY'S BEADS**, the name given to the last disappearing and the first reappearing fringe of the sun during a total eclipse. This fringe, owing to irregularities of the moon's limb, in turn due to the mountains of the moon, appears broken up into a number of separate points of light.

**BAIN, ALEXANDER** (1818-1903), Scottish philosopher, was born at Aberdeen, June 11, 1818. He was educated at Marischal College where in 1841-45 he was professor of moral philosophy. In 1845-46 he lectured on natural philosophy at the Andersonian University in Glasgow and in 1857-62 was examiner in logic and moral philosophy at the University of London. In 1860 Bain became professor of logic in the University of Aberdeen and in 1881 was elected rector.

Bain's most important works were *The Senses and the Intellect*, *The Emotions and the Will*, *Mental and Moral Science*, *Logic, Deductive and Inductive*, *James Mill, a Biography*, and *John Stuart Mill, a Criticism*. He died at Aberdeen, Sept. 18, 1903.

**BAINBRIDGE, WILLIAM** (1774-1833), an American naval commander, was born at Princeton, N.J., May 7, 1774. Early following the sea, he entered the U.S. Navy in 1798. He commanded the schooner *Retaliation* when it was captured by French frigates, which resulted in the passing of the so-called "Retaliation Act" against impression. In 1801, in command of the *Philadelphia*, he served in the warfare against the Barbary States, capturing a Moorish vessel, but in turn running aground in Nov., 1803. He was taken prisoner and held with his men at Tripoli, while the *Philadelphia* was burned by Decatur who dashed into the harbor in 1804. He was in command of the United States frigate *Constitution* during the War of 1812, when he captured the British frigate *Java*. After the close of this war, he continued in the U.S. Navy, establishing the naval training school at Boston and acting as commandant of the navy yards at Philadelphia and Charleston. He was on the board of navy commissioners during his later years. Died at Philadelphia, July 28, 1833.

**BAINBRIDGE**, a city in southwestern Georgia, the county seat of Decatur Co., on the Flint River, about 200 mi. southwest of Macon. Bus lines, river craft and two railroads afford transportation. The vicinity produces cotton, peanuts and tobacco, poultry and live stock. The city is a shipping and manufacturing center, producing bottle washing machinery, boxes and Fuller's earth. Bainbridge was founded in 1822. Pop. 1920, 4,792; 1930, 6,161.

**BAIRAM**, the name given in Turkey and in Egypt to the two most important annual feasts of the Moslems, known generally as the *Baqar-Id*, or "cattle-festival," or *Idul-Adha*, or "feast of Sacrifice," and *Idul-Fitr*, or "festival of the breaking of the fast." The latter, or "little" Bairam, begins at the end of the annual fast of Ramadan and lasts three days. The former or "great" Bairam, lasts four days from the roth of the month of Pilgrimage—some two months after "little" Bairam.

**BAIRD, SPENCER FULLERTON** (1823-87), American naturalist. He was professor of natural history in Dickinson College in 1845 and later became secretary of the Smithsonian Institution at Washington, D.C. Through his efforts the Commission of Fisheries was established by Congress, and he was placed in charge. Baird was the author of a number of monographs on fishes, reptiles and birds, and in collaboration with Thomas M. Brewer and Robert Ridgway published *History of North American Birds*. He also wrote *Mammals of North America*. Baird was born at Reading, Pa., Feb. 3, 1823 and died at Woods Hole, Mass., Aug. 19, 1887.

**BAJAZET I** (1347-1403), Sultan of the Turks, was born in 1347. He was the son and successor of Murad I. Bajazet, sometimes called "The Lightning," was a successful leader and general, over-running in three years Macedonia, Bulgaria and many states of Asia Minor. He continued his success until 1396 when at Nicopolis he defeated a combined French, Polish and Hungarian army. However, in 1402, at Angora he was defeated by TIMUR and died the following year.

**BAJZA, JOSEPH** (1804-58). Hungarian poet, was born at Szucs, county of Heves, Jan. 31, 1804. He edited *Aurora*, 1830-37; in which his earliest contributions appeared. During the same period, 1830-36, he also edited *Kritikai Lapok*, and the *Athenaeum*, 1837-43. Five years later, he was appointed editor of *Kossuth Hirlapja*. In 1837, he became director of the National Theater at Pest, and published a series of foreign plays. His poems rank high in Hungarian lyric poetry. Bajza died Mar. 3, 1858.

**BAKELITE**. See PLASTICS; RESINS, SYNTHETIC.

**BAKER, GEORGE FISHER** (1840-1931), American financier, was born at Troy, N.Y., Mar. 27, 1840. He began work as a clerk in the New York State banking department, then went to New York City as a bank clerk, and later held office of importance with the New York Central and other large railroad companies. He became chairman of the board of directors of the First National Bank, New York City, and was director, at various times, of more than 40 public utilities companies. Baker founded and endowed the Graduate School of Business administration, Harvard University. He died at New York, May 2, 1931. His son, George Fisher Baker, Jr., was born in New York City, Mar. 19, 1878.

**BAKER, GEORGE PIERCE** (1866- ), American author and educator, was born at Providence, R.I., Apr. 4, 1866. He was educated at Harvard and

Yale. The founder of *The 47 Workshop* at Harvard, a laboratory for aspiring dramatists, in 1925 he joined the Yale faculty as professor of history and drama technique, also acting as director of the Yale University Theater. The success of his lectures and laboratory methods relating to playwriting has been evidenced in part by the work of certain of his former pupils, among whom were EUGENE O'NEILL and PHILIP BARRY. His published works include *The Development of Shakespeare as a Dramatist*, 1907, and *Dramatic Technique*, 1919.

**BAKER, NEWTON DIEHL** (1871- ), American lawyer, was born at Martinsburg, W.Va., on Dec. 3, 1871. He was educated at Johns Hopkins University, where he graduated in 1892, and at Washington and Lee University, where he received the degree of bachelor of laws in 1894. Two years later he became private secretary to Postmaster-General Wilson for a period of one year. He began to practice law at his birthplace in 1897. Moving to Cleveland, O., he was appointed city solicitor in 1902 by Mayor THOMAS L. JOHNSON to assist him in effecting municipal reforms. Elected and reelected to the office of city solicitor from 1904 to 1912, Baker not only demonstrated his skill in municipal government, but also organized an enthusiastic following which elected him mayor in 1912. He declined to enter President Wilson's cabinet in 1913 as secretary of the interior, but three years later accepted appointment as secretary of war. His assumption of the duties of the war department was viewed with foreboding by those who disapproved of his apparent association with the pacifist movement. But Baker's conduct of his office during the World War brought him the praise of civilians and military leaders alike. In Mar. 1921 he returned to the practice of law in Cleveland, though he devoted a considerable part of his time to a discussion of American foreign policies and urged the entrance of the United States into the League of Nations. At the Democratic convention of 1924 he made an impassioned plea for his party to take a firm stand in support of the League. After his name was prominently mentioned for the Democratic Presidential nomination in 1932, he stated that it would be unwise for the United States to enter the League unless a large majority of the voters favored such action, but he reaffirmed his belief in the League as an instrument of peace.

**BAKER, RAY STANNARD** (1870- ), American author and journalist, was born at Lansing, Mich., Apr. 17, 1870. He held editorial positions with the *Chicago Record*, *McClure's Magazine* and the *American Magazine* and wrote many articles on social and economic subjects. His published works include *Our New Prosperity*, 1900, *The Spiritual Unrest*, 1910, and a series of books on the life of Woodrow Wilson. Baker has also written essays under the name of David Grayson.

**BAKER, SIR SAMUEL WHITE** (1821-93), English author and explorer, was born in London, June 8, 1821. He was knighted after his discovery of Lake

Albert Nyanza in 1864 and later headed an expedition sent by the Khedive of Egypt to annex and open the newly explored country to trade. Subsequently he traveled and explored in Syria, India, Japan, Cyprus and North America. His publications include *Eight Years' Wanderings in Ceylon*, 1855, *The Albert Nyanza*, 1866, *Cyprus as I Saw it in 1879*, and *Wild Beasts and their Ways*, 1890. Baker died at Newton Abbott, England, Dec. 30, 1893.

**BAKER**, a city in northeastern Oregon, the county seat of Baker Co., situated 338 mi. southeast of Portland. It is served by bus and truck lines and the Sumpter Valley and the Union Pacific railroads. There is an airport. Baker is the largest city in the eastern part of the state, and a mining center surrounded by gold, silver and copper deposits. Lumbering, stock raising, dairying and farming are important interests. The chief industry is lumber milling. Baker is situated on the Old Oregon Trail, near the imposing Elkhorn Mountains. Whitman National Forest lies on the northeast and on the west. The city was founded in 1862. Pop. 1920, 7,729; 1930, 7,858.

**BAKERSFIELD**, a city and county seat of Kern Co., southern California, about 100 mi. northwest of Los Angeles. Buses, the Southern Pacific and Atchison, Topeka and Santa Fe railroads, and an airport serve the city, which also enjoys air mail service. Bakersfield is located in a rich agricultural region producing grapes, cotton and alfalfa. The principal industrial establishments are oil refineries. The industrial output, 1929, was worth \$10,064,144. In 1929 the retail business amounted to \$18,897,132; automobiles comprised the largest sales. In addition to oil the natural resources include silver, gold, soda and borax deposits. Pop. 1920, 18,638; 1930, 26,015.

**BAKER UNIVERSITY** at Baldwin City, Kan., a coeducational institution controlled by the Methodist Episcopal Church, was founded in 1858. It has productive funds of \$1,498,862. The library of 55,000 volumes contains the Bishop Quayle collection of Bibles. In 1931-32 there was a student enrollment of 350, and a faculty of 33, headed by Pres. Wallace B. Fleming.

**BAKERY INDUSTRY**, UNITED STATES. This industry embraces establishments engaged primarily in baking bread, biscuits, crackers, cakes and pastry. The rapid expansion of the industry, which has been most marked in the large cities, is shown in the accompanying table.

BAKERY PRODUCTS, U.S., 1899-1929

Year	No. Establishments	Wage Earners	Wages \$	Value of Products \$
1899..	14,836	60,192	27,864,024	175,368,682
1909..	23,926	100,216	59,351,386	396,864,844
1919..	25,095	141,592	158,237,059	1,151,896,318
1929..	20,785	200,841	274,561,581	1,526,110,811

**BAKING POWDER**, consists of three ingredients—sodium bicarbonate, which contains carbon dioxide gas; acid, which releases the gas; STARCH, which pre-

vents reaction between the sodium bicarbonate and acid until moisture is added.

There are four types of baking powders. Each contains sodium bicarbonate; acid is the variable ingredient. Tartrate powders contain tartaric acid or its acid salts; phosphate powders contain acid salts of phosphoric acid; sodium aluminum sulphate powders contain compounds of aluminum; combination powders contain acid salts of phosphoric and sulphuric acids. Baking powders are not interchangeable in amount; they should be used in the proportion suited to the type. M. S.

**BAKST, LÉON NIKOLAJEWITCH** (1866-1924), Russian scenic designer, was born at Petrograd in 1866. The depiction of political conditions in his early paintings displeased the authorities and he removed to Paris in 1906. He soon made a reputation as a designer of stage settings, among the finest of which were the exotic designs for the Russian ballets, *Cleopatra*, 1908, and *Scheherazade*, 1909. Later notable scenic productions designed by Bakst included the sets and costumes for *Sleeping Princess*, the Tschai-kowsky ballet produced at London in 1921. He died at Paris, Dec. 27, 1924.

**BAKU**, capital of the Azerbaidjan S.S.R. and leading Caspian port situated on the southwestern coast of the sea near the Apsheon Peninsula. Baku's modern development is largely due to the rich oil deposits of the environs and the city is an oil shipping and oil refining center; cotton, iron and wine are among its other exports. It exchanges its products for goods from the East at an annual spring fair. There are rail connections with the Black Sea. Turkish inhabitants predominate with the Russians and Armenians following. Baku's history begins with the 5th century. Arabs, Persians and Turks controlled the city until Russia's domination prevailed in 1806. The present industrial development started in 1872 with the invention of the oil drill. The metropolis witnessed sporadic uprisings in the early part of the 20th century.

Baku comprises a modern city, also the old oriental quarters, surrounded by a fort. Within the old town are a 15th century Khan's palace, a medieval mosque and other relics of Eastern civilization. The Maiden's Tower is a massive cylindrical structure formerly used as a lighthouse. In contrast are a number of new buildings including museums, a state university, a polytechnic institute, an art school and several theaters. The climate is hot and dry. Pop. 1926, 453,333.

**BAKUNIN, MIKHAIL** (1814-76), Russian communistic anarchist, was born at Torjok, Government Tver, in 1814, of aristocratic family. Disagreeing with the autocratic methods in the army, he left it to study philosophy at Berlin. From 1840 Bakunin was in close contact with the radical socialists in Western Europe and took part in the revolutionary movement of 1848 in Germany. In 1851 he was exiled to Siberia; escaped to Japan and thence to London in 1861 where he became the leading militant anarchist in Europe.

He founded the alliance of Social Democracy which was absorbed in the International in 1869. Bakunin published numerous articles in the papers and periodicals, but his philosophy was not original, closely resembling that of Proudhon. Retiring from active life in 1873, he resided in Switzerland until his death, June 13, 1876.

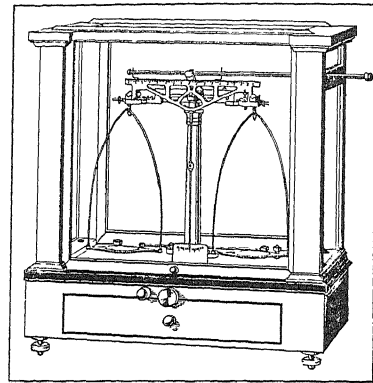
**BALAAM**, son of Beor, an early prophet of the Mosaic period; not, however, a Hebrew, but a native of Midian. Three times did Balak king of Moab send for Balaam to curse the invading Israelites. At the third summons, Balaam started on his ass, which animal, despite blows from Balaam's staff, was halted three times by an angel, unseen by the prophet himself. Balaam's ass is thus proverbial as the symbol of stupidity that sometimes sees more than wisdom. Meeting Balak, the prophet ordered sacrifices and three times uttered a blessing on Israel instead of a curse, thus reversing the prophecy. His words, "How goodly are thy tents, O Jacob, and thy tabernacles, O Israel!" rank with the noblest utterances in literature (Numbers 22, 23, 24) and reveal Balaam as the champion of fidelity to divine inspiration, however unpalatable it be to a powerful patron. Tradition accuses Balaam (II Peter 2:15; Revelation 2:14) of seeking to demoralize the Israelites by tempting them to ally themselves with Moabite and Midianite women (Numbers 25, 31:16). In a battle with Midian (Numbers 31:8) Balaam was slain.

**BALAFRUSH.** See BARFRUSH.

**BALAKIREV, MILY ALEXEIVICH** (1837-1910), Russian music composer, was born at Nijny-Novgorod, Jan. 2, 1837. An adherent of nationalism in art, he exerted his influence in fostering Slavic music. The most important of his many pupils was ALEXANDER BORODIN. With Gabriel Lomakin and V. Stassov he founded the St. Petersburg Free School of Music in 1862, continuing as its director until 1873, meanwhile, in 1869, accepting the post of conductor of the Imperial Music Society. His most successful compositions were the symphonic poem *Tamara* and a pianoforte fantasy *Islamey*. He also wrote incidental music to *King Lear*, one symphony, and about sixty songs, described by PETER TSCHAIKOWSKY as "little masterpieces." He died at St. Petersburg, May 16, 1910.

**BALANCE**, a mechanism used in determining the weights of a body. There are two general types of beam balances. In the most common and most accurate type, the fulcrum is centrally located, and a pan is suspended on each end of the balancing beam. The body to be weighed is placed in one pan and the beam is then balanced by placing weights of a known value in the other pan. To facilitate accurate balancing, a small, movable weight, or "rider," is generally mounted on one arm of the balance. In another type, the fulcrum is located near one end of the beam. A pan is suspended at the end of the short arm of the beam, and a constant weight is suspended on the long arm in such a manner that its position, and, consequently, the effective length of the arm, can be varied

to balance an unknown weight in the pan. In all balances the balancing beam is suspended on a knife-edge fulcrum, as are the pans at the ends of the beam. Great accuracy may be attained in weighing with bal-



COURTESY CHRISTIAN BECKER CO.

SHORT BEAM ANALYTICAL BALANCE

ances, and they are used much in scientific work. The balance is one of the oldest measuring instruments, being employed by the ancient Egyptians. See also TORSION BALANCE.

**BALANCE OF POWER**, the principle of balancing political forces in a society of states so that no state singly or in alliance with others shall be able to impose its will upon the rest. In England the policy originated with Cardinal Wolsey and was applied by him to France and Spain. The opposition to the great power of Spain under Charles V and Philip II, to France under the ambitious Louis XIV, and again under Napoleon, and in the 20th century to Imperial Germany, illustrate this statecraft. To-day the extraordinary strength of France supplemented by her alliances and her vast colonial empire is causing uneasiness lest the equilibrium of power in Europe be destroyed.

**BALANCE OF TRADE**, the difference between the volume of merchandise IMPORTS and the volume of merchandise EXPORTS of a country. It may be either an import balance or an export balance. Thus in 1930 imports into the United States amounted to \$3,061,000,000, while exports amounted to \$3,843,000,000 giving the United States an export balance of \$782,000,000. The balance of trade should be distinguished from the balance of INTERNATIONAL PAYMENTS which refers to all international transactions.

An export balance is commonly called a favorable balance, while an import balance is called an unfavorable balance. These terms are an inheritance from the Mercantilist belief in the benefits of an excess of exports. The chief justification for the belief that an export balance is favorable while an import balance is unfavorable, is that the former may help to prevent an outflow of GOLD. Occasionally it is true that a nation finds itself compelled to conserve its gold supply by stimulating exports relative to imports. Thus,

the payment of reparations by Germany will require a larger volume of exports than otherwise would be necessary. In normal circumstances, however, there is no evidence to show that an excess of exports is more to be desired than an excess of imports.

This statement becomes plain if two general principles in regard to the forces determining the nature of a country's trade balance are understood. The first is that a change in the relative volume of exports and imports tends to correct itself automatically. An outflow of gold coming as the result of a deficiency in exports itself sets forces in motion that discourage imports and encourage exports. This corrective influence is felt in two ways. First, when gold is exported in quantities it means that exchange rates have been rising. This in turn means that an importer must pay more for the foreign exchange (*see FOREIGN EXCHANGE AND CENTRAL BANKS*) he wishes to buy and that an exporter receives more for the exchange he has to sell. Thus the importer is discouraged and the exporter encouraged. Second, when gold leaves a country prices will tend to fall. This decline will make that country a better one in which to buy and a poorer one in which to sell.

Thus exports are again stimulated and imports retarded. The second principle underlying the nature of a country's balance of trade is that a permanent excess of imports or exports is met, not by the shipment of gold, but by many other transactions transpiring between nations. The variety of transactions taking place across the boundaries of a nation is not essentially different from those within a country. A large excess of exports or imports simply means, therefore that a country has other foreign transactions that require the transfer of funds in the reverse direction. In 1929, for instance, sums received by the United States for its excess of exports were actually less than the sums transferred out of the country by tourists and immigrants.

The World War caused violent disturbances in the trade balances of most nations. Nations that have shown marked import balances since the war are the United Kingdom, Belgium, France, Italy, the Netherlands, China, and Australia. Typical nations with conspicuous export balances are the United States, Argentina, and India.

During the decade of the '70's the trade of the United States shifted from an excess of imports to an excess of exports. During the 86 years from 1790 to 1875 imports exceeded exports in all but 15 years. Since 1875 exports have been the larger in nearly all years. Many observers predicted another overturn in the trade balance soon after the World War because of the repayment of the war loans. Imports did reach 92% of exports in 1926. A. F. L.

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**BALANCE SHEET**, a statement of financial condition, usually prepared from a double-entry set of books. Differentiation is sometimes made between

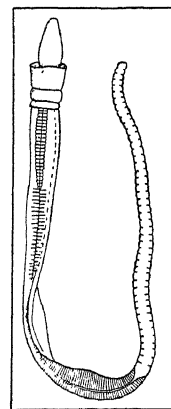
such a statement and a similar one drawn up from other sources, such as single-entry records, memoranda and appraisal data, this latter type of statement being called a statement of Assets and liabilities. Either statement when properly drafted gives the same general information and contains schedules of assets, liabilities and net worth or proprietorship. The balance sheet should be so set up as readily to give information as to the solvency of the business and its stability. By solvency is meant the ability to meet its obligations as they come due. To set forth this information the assets and liabilities are classified into current, fixed and other (*see ACCOUNTING*). A comparison of CURRENT ASSETS with CURRENT LIABILITIES indicates roughly the solvency of the business. This ratio is termed the current ratio. Information as to stability is provided by the "fixed" classes of assets and liabilities. The portion or percent which the borrowed CAPITAL bears to the total capital investment in fixed property is shown by the ratio of fixed liabilities to FIXED ASSETS. The net worth schedule or section of the balance sheet shows the owner's proprietary interest or equity in the enterprise. It usually shows capital invested as such and profits earned but not yet distributed to owners, being used in the business as additional capital. R. B. K.

**BALANOGLOSSUS**, the common name for marine worm-like animals which form an order (*Balanoglossida*) of *Hemichordates*. They are found in all tropical and temperate seas, generally in shallow water, where they burrow in the soft bottom. Like earthworms they pass sand and mud through their bodies for the sake of the organic particles contained therein. At the forward end of their bodies is a cap-like structure, called the proboscis; next comes a distinct collar, and beyond that is the long trunk. The proboscis and collar contain the only muscles concerned with movement, which is accomplished by wriggling. There are separate sexes, and the genital products are discharged into the sea.

*Balanoglossus* is particularly interesting because of its position in the animal kingdom. Its larvæ are typically like those of echinoderms such as star-fish and sea urchins.

As an adult, however, it has certain features characteristic of backboneed animals, the most important of which are openings corresponding to gill-slits, a notochord, the forerunner of the vertebral column in higher animals and a dorsal nerve cord. Therefore it is considered to represent a link between the invertebrate echinoderms and vertebrates like fish, frogs and man; these creatures are perhaps all descended from a common ancestor, which was not an echinoderm, a *balanoglossus*, or a vertebrate.

**BALATA.** *See* BELTING, POWER TRANSMISSION.



BALANOGLOSSUS

**BALATON, LAKE**, a lake of central Europe, in west central Hungary, about 54 mi. southwest of Budapest. Extending from northeast to southwest, it covers an area of more than 250 sq. mi. The lake is 350 ft. above sea level and is divided into two parts by the peninsula of Tihany. Balaton is remarkable for its shallowness, its average depth being only about 10 ft. On the north shore are mineral springs and intensively cultivated vineyards, beyond which are the Bakony Mountains. Along the flat southern shore are popular watering places. Small fishing settlements are numerous. The water, although fed by many springs and streams, is slightly alkaline. The lake discharges into the Danube.

**BALBO, CESARE** (1789-1853), Italian statesman and writer, was born at Turin on Nov. 21, 1789. He served under Napoleon, afterwards devoting himself to the house of Savoy. As prime minister of Sardinia in 1848 he aimed at freeing Italy from foreign control. He wrote *Storia d'Italia* in 1830, and his *Delle Speranze d'Italia* won him an international reputation. He died in 1853.

**BALBOA, VASCO NUNEZ DE** (c. 1475-1519), Spanish soldier and conquistador, who led the first party of white men across the Isthmus of Panama and discovered the Pacific Ocean. He was born in Jerez de los Caballeros, of ancient and noble family, sailed to America with Rodrigo Bastidas in 1501, and became a planter in Española. His efforts were not successful, and in 1510, to escape his debtors, he concealed himself on a ship, setting out to carry provisions to Ojeda. The settlement of San Sebastian (Colombia), which Ojeda had established the previous year, was about to be abandoned when the party arrived. Balboa suggested that they sail to Darien, which he had visited with Bastidas on his previous voyage. The proposal was adopted and the colony of Santa Maria la antigua del Darien was established.

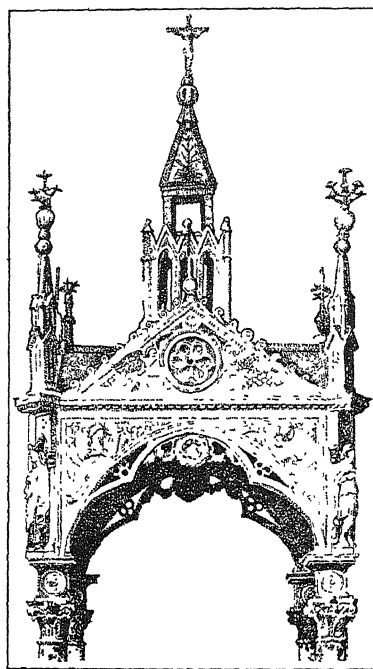
Balboa became leader of the colony and began conquering the Indians by war and by diplomacy which won him the friendship of several chiefs. From these he heard of the Pacific and of a land of much gold, and determined to find his way there. His determination was strengthened by the necessity of doing something to ingratiate himself in the eyes of the king, and he set out with an expedition to look for the great water and came into sight of it Sept. 25 or 26, 1513. On Sept. 29, he named it the South Sea, and took possession in the name of the Crown. Balboa had been appointed lieutenant of Diego Columbus, but his petitions to the king came too late, and in 1514 Pedrarias Davila was appointed governor, arriving at Darien in June of the same year. The early formalities over, hostility broke out immediately between Balboa and Pedrarias, who was jealous and wished to take for himself the honor of making settlements on the South Sea.

Meantime, the king named Balboa Adelantado of the South Sea, and governor of Coiba and Panama, subject to the governor, Pedrarias Davila. Temporary peace was effected by the marriage of Balboa to the

daughter of Pedrarias, but this was soon broken. Balboa was preparing an expedition to explore the South Sea, but when on the point of departure, received orders to return to Darien. Here he was placed under arrest and accused of treason. He was tried and condemned, Pedrarias signing his death warrant. He was decapitated in Jan. 1519. B. W. D.

**BALBOA**, a town of the PANAMA CANAL ZONE, at the Pacific entrance to the canal, 1 mi. northwest of Panama, for which it serves as a port. It is the administration seat of the Canal Zone, the site of a military post and naval station. The administration building, a 3-story concrete structure, is situated at Balboa Heights, a hill above the town; behind this building is the residence of the military governor. The chief thoroughfare of Balboa is the Prado, laid over reclaimed swampland. The town contains a community house, several churches, Y.M.C.A. center, schools and a playground. Pop. Balboa and Balboa Heights, 1930, 3,556.

**BALDACHINO**, a canopy supported on columns over an altar, bed or throne; sometimes in church work also called CIBORIUM. Developed baldachinos of



A 13TH CENTURY BALDACHINO IN THE CHURCH OF SANTA CECILIA, ROME  
Probably the work of Arnolfo di Cambio

great richness were evidently almost universal in the early Christian work of Italy and in Byzantine churches. From the 10th century on they became less and less common, and Gothic altars were largely without them, except in Italy, where their use persisted. The rich structure of metal, gilt, enamel and precious stones over the altar in the Saint Chapelle in Paris, about 1245, is exceptional, being in reality more of a reliquary and shrine than a baldachino. The earlier

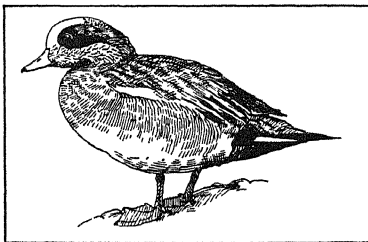


examples are of two general types. In those in which classic influence is dominant, four columns at the corners support entablatures which in turn carry small colonnettes that uphold a pyramidal or gabled roof, for example, San Lorenzo, Rome, 9th century, and Church at Castel Sant' Elia, 10th century. In those under Byzantine influence, the columns support four arches often with gables above, as in San Ambrogio, Milan, 11th-12th centuries. There are magnificent Gothic baldachinos of the 13th and 14th centuries in Rome in the churches of Santa Maria in Cosmedin, Santa Cecilia, San Giovanni in Laterano, and St. Paul Outside the Walls. The building of the great bronze baldachino over the high altar of St. Peter's in Rome by Bernini in 1633 led to a new vogue of the baldachino during the baroque period, reflecting the changed attitude towards the sacraments that followed the counter reformation.

**BALDER**, the Norse god of light, son of ODIN and Frigg, and husband of Nanna. He was made invulnerable to everything except the mistletoe. Loki, the god of evil, knew this and threw a branch of the plant at Balder, who immediately died. The myth is generally thought to signify the blotting out of the sun by the winter storms.

**BALDNESS** (Alopecia): Treatment for. See LIGHT, ARTIFICIAL, IN TREATMENT OF DISEASE.

**BALDPATE**, a species of dabbling duck, so-called from the white crown of the head, and also called the American widgeon. It is smaller than the mallard but larger than the teal. The baldpate (*Mareca americana*) in breeding plumage has a metallic green band behind the eye, head and neck buff-white, speckled breast, wine-colored, back light brown with fine black lines, wing coverts white, speculum green; primaries and tail gray; underparts white. The female is duller, lacking the green and white on the



DRAWING BY GEORGE MIKSCH SUTTON

BALDPATE OR AMERICAN WIDGEON

head. The baldpate breeds in the northwest of North America from Alaska to Indiana, and winters south to Central America and the West Indies, many wintering near the east coast of the United States from Massachusetts south. Like other river ducks the baldpate rarely dives but often robs diving ducks like the canvas-back and redhead. The European widgeon drake has a reddish-brown head with cream-colored crown. The female is very like the American species. The European Widgeon (*M. penelope*) is occasionally seen in eastern North America. C. J.

**BALDWIN**, the name of several kings of Jerusalem, members of the House of Flanders, who ruled during the era of the Crusades. Baldwin I (1058-1118), the first of the line, was the youngest brother of Godfrey of Bouillon. Baldwin was one of the adventurous princes of the First Crusade, which he joined in 1096. Upon the death of his brother Godfrey in 1100 Baldwin assumed the title of King of Jerusalem and reigned about 11 years. Baldwin II (d. 1131), nephew of Baldwin I, reigned in 1118-31. During this period Tyre was captured and the Order of the Templars founded. Baldwin III, grandson of Baldwin II, reigned from 1143 to 1162. In his reign the Latin Kingdom of Jerusalem attained its highest power. Baldwin IV, grandson of the foregoing, ruled in 1173-83 and was succeeded by his nephew, Baldwin V, a mere child, who died in 1186.

**BALDWIN, JAMES MARK** (1861- ), American philosopher and psychologist, was born at Columbia, S.C., Jan. 12, 1861. He was professor at Johns Hopkins, 1903-09, and later at the National University of Mexico. As a psychologist Baldwin became noted for the genetic viewpoint, to the development of which he contributed. From 1901 to 1906 he was editor of the *Dictionary of Philosophy and Psychology*. Among his works are *Handbook of Psychology*, 1890-91, *Mental Development*, 1906, *Social and Ethical Interpretations*, 1898, *History of Psychology*, 1913, and *Between Two Wars*, 1926.

**BALDWIN, ROBERT** (1804-58), Canadian statesman, was born in York (Toronto), May 12, 1804. He was educated as a lawyer, admitted to the bar in 1825, and, a naturally constructive thinker, soon became absorbed in politics. As an opponent of the ruling oligarchy, he avoided the extremes of his colleague WILLIAM L. MACKENZIE and committed himself to life-long agitation for responsible government. He was unhappy in several tenures of public office, being too strongly devoted to principle to be successful politically; he resigned a post in the executive council of Upper Canada in 1836, a similar post in 1841, and a government post in 1843, in each case after only a few months' service. In 1848 a coalition of the French followers of Louis Lafontaine and the moderate reformers led by Baldwin, which in 1842-43 had held short-lived predominance, was returned to power. The administration of 1842-43 had been the first to accept responsible government; that of 1848-51 achieved it. Lacking sympathy with the radical wing of his party, Baldwin resigned in 1851 and returned to private life. He died Dec. 9, 1858.

**BALDWIN, STANLEY** (1867- ), British conservative statesman and prime minister, born in Worcestershire and educated at Cambridge University. After twenty years in the iron manufacturing business he entered Parliament as a Conservative in 1908 and served as financial secretary to the treasury from 1917 to 1921. During the World War he volunteered 25% of his private fortune to the national treasury. He became a member of the privy council in 1920; president of the British Board of Trade, in 1921; commissioner for funding British war debt to United States,

in 1923; and prime minister, in May 1923. His first premiership lasted a short time, but he was returned nine months later with a conservative majority, played an important part in the Locarno treaties, and settled the general strike in 1928. His party failed to get a majority of the House of Commons and from 1929 to 1931 he led the opposition to the second Labor Government. In 1931, he joined Ramsay MacDonald and Snowden to form the National Government. The November elections returned an overwhelming majority for the Coalition, and especially for the Conservatives, Baldwin becoming minister of the Council.

**BALEARIC ISLANDS**, a group of islands of the Mediterranean, lying east of the Spanish coast and forming a province of Spain. Only four of them are large, namely MAJORCA, MENORCA, IVIZA and FORMENTERA. The rest, 11 in number, are very small. The total area of the Balearics is 1,936 sq. mi. They have a good climate. Agriculture and livestock breeding are the principal industries. Owing to the richness of the soil fruits, especially olives and grapes, are raised in large quantities. Shoes, majolica, laces and embroideries are made here. The principal minerals are sea salt, lignite and superphosphates. The chief town and capital of the group is PALMA, located on Majorca. Est. pop. 1929, 340,000.

**BALERS**, machines for pressing hay or straw into block-like bundles (bales) so that it may be bound with wire. They comprise a feeder, which forces the hay into a baling chamber, and a plunger, which presses the material into a compact bundle, together with suitable operating and regulating mechanisms. Modern balers are driven by gasoline engines, tractors or electric motors.

**BALFE, MICHAEL WILLIAM** (1808-70), Irish composer and opera singer, was born at Dublin, May 15, 1808. He went to Italy to compose opera and to sing, and returning to England made a success in 1835 with the *Siege of Rochelle*. Balfe produced twenty English operas, wrote successfully in French and Italian, and scattered throughout his sentimental scores such melodic arias as *When Other Hearts* and *I Dreamt I Dwelt in Marble Halls*. *The Bohemian Girl*, his best known work, is occasionally produced to-day. He died in Herfordshire, Oct. 20, 1870.

**BALFOUR, ARTHUR JAMES, EARL** (1848- ), British statesman and author, born in Scotland, July 25, 1848. He was educated at Eton and Cambridge, becoming private secretary to his uncle Lord Salisbury in 1878. After holding the posts of secretary for Scotland, chief secretary for Ireland and first lord of the treasury he succeeded Salisbury as prime minister in 1902-05. In 1915 Balfour became first lord of the Admiralty, as a member in the cabinet of Lord Asquith; from 1916-19 he acted as secretary of state for foreign affairs in Lloyd George's war cabinet; in 1917 he went to America, as the spokesman of the British mission and was the leader of the British delegation to the Washington Conference, 1921-22. He is the author of *A Defense of Philosophic Doubt*, *Criticism and Beauty*, and other works.

**BALI**, an island of the Dutch East Indies, lying east of Java and separated from it by the Strait of Bali. It is about 90 mi. long and 50 mi. wide, and comprises an area of 2,168 sq. mi. The surface is mountainous, the highest summit, Gunung Agung, an active volcano, reaching a height of approximately 11,000 ft. The island is well-watered and produces among other commodities rice, coffee and tobacco in large quantities. The inhabitants are Malays but speak a distinct tongue known as Balinese. Buleleng, in the north, is the largest town and capital of the residency, which includes the island of LOMBOK. Pop. of Bali, 1925, 946,387; of the Residency of Bali and Lombok, 1927, 1,586,652.

**BALIKESIR**, a city of Anatolian Turkey and capital of the vilayet of Karasali, situated in a fertile plain about 75 mi. southwest of Brusa. It has many mosques. Balikesir is believed to occupy the site of the Roman town Hadrianutherae, founded by the Emperor Hadrian. An annual fair attended by thousands of people is held here. Grain, silk and opium are the chief articles of trade, although many minerals, including silver and boracite, are found in the neighborhood. Pop. 1927, 135,473.

**BALIEL, JOHN DE** (1249-1315), King of Scotland, 1292-96. Before receiving his crown Baliol swore fealty to Edward I of England, but, in 1495, he entered into an alliance with France, then at war with England. For this breach of loyalty Edward invaded Scotland in 1296 and forced the abdication of Baliol, who later withdrew to his estates in France.

**BALKAN LEAGUE, THE**, an association of Balkan powers in 1912 for united action against Turkey. Taking advantage of the Tripolitan War, Serbia, Bulgaria and Greece negotiated alliances among themselves and opened the First Balkan War in Oct. 1912. The league was completely victorious over Turkey, capturing even Adrianople, but it was unable to withstand the strain of dividing the spoil. This difficulty led to the Second Balkan War, July 1913, in which the other allies, joined by Rumania and Turkey, defeated Bulgaria.

**BALKAN MOUNTAINS**, a range which runs in a shallow crescent-shaped curve from the Timok River in Bulgaria south and east to Cape Eminch on the Black Sea. The range, although it has a nucleus of old and hard crystalline rock, is mainly formed of secondary limestones and sandstones. It is from 12 to 30 mi. wide. Steep limestone escarpments face the south, but the mountains slope northward in a gently inclined limestone plateau to the Danube. The range is not unbroken but consists of numerous groups of mountains. Its central portion is much the highest, reaching an average elevation of 5,000 to 6,000 ft. The highest peaks here are Yumrukchal, 7,790 ft. and Veshen, 7,220 ft. The forms of the ridges and peaks are rounded and dome-shaped, and are covered by forests of oak, beech and fir.

The Balkan Mountains are crossed by numerous roads. The most important of these utilize the Shipka Pass, 4,375 ft. high.

**BALKAN PENINSULA**, the most easterly of the three great peninsulas of southern Europe. It is bounded on the north by the rivers Danube and Save, south and east by the Ægean Sea, Sea of Marmora and the Black Sea, and west by the Adriatic and Ionian Sea. Before the World War it consisted of the following territories and states: Albania, Bosnia and Herzegovina, Bulgaria, Croatia-Slavonia, Dobruja, Greece, Serbia, Dalmatia, Montenegro and Novibazar. Though the area forms, in spite of great diversities in physical features, climate and products, an easily recognized geographical unit, political settlements since the war made it necessary to treat large portions of it elsewhere. The total area is about 180,000 sq. mi., and the population 18,000,000.

The great importance of the peninsula depends upon the fact that the channels separating it from Asia Minor are so narrow that it forms a bridge between Europe and Asia, connecting the mountain structure of the continents, and interposing no barrier to plants and animals, or human movements. Through its channels it commands the communication between the Black Sea and the Mediterranean. The Balkan bridge to Asia consists of a series of defiles separated by mountain barriers. Through these narrow pathways have swarmed, since antiquity, hordes of emigrants from the steppe lands of western Asia. Thus successive human invasions have given the region a racial composition as varied as its relief. Because of this great variety of relief and racial composition, and the fierce enmities fostered by centuries of strife accentuated by the rivalries of the great European powers, the development of the Balkan peoples has been most seriously handicapped.

Five independent nations (Yugoslavia, Bulgaria, Turkey, Albania and Greece) now occupy the peninsula, and within some of these five are elements of dissension so serious that prolonged or close cooperation is practically impossible. The first Balkan war of 1912 was the only occasion upon which the countries, exclusive of Turkey, had united forces to achieve a common end; but the alliance was short lived and was soon followed by quarrels over spoils of war.

**BALKAN WARS**, the armed struggles among the nations of the Balkan Peninsula during 1912-13, arising from boundary disputes and from the dominance and oppression of the Turks. With Turkish control in Europe weakened by the revolution of 1908 (see **TURKEY**), Bulgaria, Serbia, Greece and Montenegro united in 1912 against the Turks, and drove them from all footholds in Europe except Constantinople and the territory in close proximity. Over the spoils of this war Bulgaria and Greece disagreed, bringing on the war between Bulgaria on one hand and Greece, Serbia, Montenegro and Rumania on the other. Bulgaria was severely defeated. See also **WORLD WAR**; **BULGARIA**; **SERBIA**.

**BALKHASH, LAKE**, in the Kazal, A.S.S.R. of Asiatic Russia, between 45° and 46° 30' N. lat., and 73° 20' and 79° E. long. Area 8,400 sq. mi., total

length 330 mi., breadth 4 to 50 mi. Its principal feeder is the river Ili; there is no outlet. The lake, which is slightly brackish, and generally frozen over from December to April, abounds in fish.

**BALLAD**, a folk-song telling a story, at one time with an air and a dance accompanying it. All European countries and the East also have probably had ballads from time immemorial. The ballads of various peoples have much in common, both in plots and details of style; for example, the lavish use of gold: horses shod with gold, golden birds, golden clothing are popular in many parts of the world. Love, death and the return of the dead were favorite themes.

Scotland and England are rich in ballads. *The Bonny Earl of Murray*, *Sir Patrick Spens* and *The Two Sisters* are among the best. *Chevy Chase*, Sir Philip Sidney claimed could stir the blood like a trumpet. Ballads have been edited by their collectors, thereby losing something of their original simplicity and vigor. F. J. Child's *English and Scottish Popular Ballads* is the fullest and most scholarly collection.

The ballad in America is largely imported, but the cowboy and Kentucky mountaineer songs are ballads of a kind. Carl Sandburg's *American Song Bag* is a collection of this class.

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**BALLARAT**, a leading commercial city of Victoria, Australia, lying about 1,420 ft. above sea level and enjoying an invigorating climate; it is made up of Ballarat West, Ballarat East and Sebastopol, with a population, 38,500 in 1921, which had increased to 42,200 by 1929. Lying inland 60 mi. from Melbourne, the city has all the institutions of a progressive district. Industries include railway shops, woolen mills, iron foundries, breweries and flour mills. There are two cathedrals.

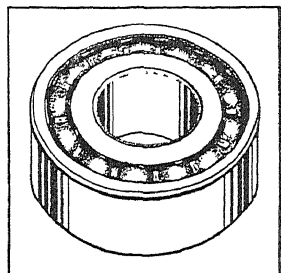
After the discovery of gold in 1851, Ballarat prospered rapidly, becoming a municipality in 1855, and a city in 1870. In 1854 grievances over unjust taxation led to bloodshed among the miners. The production of gold has decreased greatly in recent years.

**BALLAST**, a term which when used nautically, pertains to water, iron, sand or other material put in a vessel to increase her draft and stability. The term is also used for sand carried by balloons and for selected, granular material such as crushed stone, gravel, cinders, chats, slag, burned clay or gumbo, and sand placed upon the roadbed to support railroad ties. It distributes the load from the ties, provides drainage around them and permits adjustments of the track without disturbance of the roadbed itself. See also **RAILROAD TRACK**. F. A. B.

**BALLAST CAR**. See **RAILROAD WORK EQUIPMENT**.

**BALL BEARINGS**, a device to reduce friction between a revolving shaft and its support. Hardened steel balls roll between hardened steel rings, or "races," the inner race being on the shaft and the outer on the wheel or support. (See figure.) Formerly the space

between races was completely filled with balls, but at present a smaller number are used, with a "separator" to keep them apart. Ball bearings are designed to support a radial load or an end thrust, and also combinations of both.



COURTESY NEW DEPARTURE BRAKE CO

BALL BEARINGS

Usually there is a single row of balls, but double rows are not uncommon. Ball bearings vary greatly in accuracy, from the cheaper kind to highly accurate bearings with variations of .00025 in. or less. Ball bearings enable machines to be run at much higher speeds and with less lubrication; they also save much power and are now

used in nearly all classes of machines. Ball and ROLLER BEARINGS are also known as anti-friction bearings.

F. H. C.

**BALLET**, a stage spectacle in which the dance, pantomime, dramatic action, painting and music combine to depict a story drawn from various sources. The word derives from the Latin *ballar*, to dance, which has its equivalent in the Italian *ballare* or *ballette* which was adapted in French as *ballet*, now an international term for this form of entertainment. Ballet also means a company of dancers performing ballets; for instance, "Ballet of the Paris Opera" or the "Russian Ballet." This type of dancing can be traced back to high antiquity—to religious rites, church and national pageants, court entertainments—before it became a perfected theatrical art. The ballet can be dramatic, romantic or symbolical, a fairy tale, a national or historic legend or a subject from ancient mythology or religious rites. It must not be confounded with "toe dancing," which is only one of the forms of the dance used in a ballet, when the story calls for it. The name, classical ballet dancing, has its origin in the imitation of movements of antique statuary which was used to depict mythological personages in the early ballets of passed centuries.

The Egyptians had the ritual of the planets, the Greeks and Romans many sacred and secular dances and pantomimes. The latter were revived many centuries later in Italy as court spectacles and from there were transplanted to the court in France.

In Italy it can be traced to the 14th century; in France it was staged in 1581 when Catherine de Medici had her Royal Valet prepare the sumptuous *Ballet Comique de la Reine*. The most brilliant era of the court ballet was during the reign of Louis XIV, who appeared in many performances together with his courtiers. These ballets were given in the palaces of the Louvre, and at Fontainebleau, Versailles and Saint-Cloud. In 1661 the king founded the Royal Academy of Dancing. The first stage ballets in France and Italy included a great complexity of mechanical contrivances and allegorical subjects. Only men, who took the feminine rôles, appeared in them.

Although Italy was the cradle of the ballet, it was in France that it developed and from there invaded all the court theaters of Europe. Italian dancers began their careers in France and, together with the famous French dancers and balletmasters, appeared on other European stages. In 1681 the woman dancer appeared for the first time in the ballet called *Triumph of Love*, by the famous composer, J.-B. LULLY; the other famous ballet and opera composer of that time was JEAN PHILIPPE RAMEAU who composed many ballets to plots written by the dramatists Molière and Corneille. Mozart (1756-91) also contributed a ballet called *Les Petits Riens*.

The most important dancers and balletmasters of that time were Beauchamp, Pecourt, Ballon, Gaetano Vestris and his famous son Auguste, called the "God of the Dance." He introduced amazing leaps which startled audiences. The leading women dancers were La Fontaine, Prevost, Camargo and Sallé. All these invented new virtuosi stunts which gradually became the fundamental exercises of classical ballet training. As most of them originated and were perfected in France they have conserved the French terminology.

The great innovator in the art of the ballet was Jean Georges Noverre (b. 1727). He simplified the costumes, banished the masks and introduced dramatic dancing and pantomime in the 50 ballets he staged. He was called to all European court theaters to introduce the then called new ballets. He influenced the Empress Anna of Russia to develop the ballet in St. Petersburg. Those ballets were lengthy compositions of five acts with many scenes and an apotheosis at the end.

A galaxy of famous dancers and balletmasters followed Noverre, and the ballet attained high perfection in the 18th century. The most celebrated were the men, Didelot and Saint Léon, and the women, Taglioni, Elssler, Cerrito and Grisi (1811-69). Théophile Gautier, the French poet, gives detailed accounts of this period. The most famous ballets were *Giselle* and *Sylphides*, still in the ballet repertoire.

All the great dancers and balletmasters were lured to Russia by the fantastic salaries and the splendor of the performances, the court surpassing other capitals of Europe in presentation of this highly developed theatrical art. The first balletmaster in St. Petersburg at this time was Didelot, the Frenchman who conducted the ballet for 25 years. After him came the other French balletmaster, Marius Petipa, who reigned in the Imperial Theatre for 50 years. He recreated the French ballets, such as *Giselle* by Adams, *Sylphides* and *Coppelia*, by Delibes, and many others. His new ballets were *Sleeping Beauty*, *Swan Lake*, *Nutcracker*, with music by the Russian composer, P. I. TCHAIKOVSKY, *Raymonda* and the *Seasons* by ALEXANDER GLAZUNOV. Among the dancers known also in Europe were Legat, Kshesinsky Geltzer, Kshesinskaya, Preobrajenskaya.

The dancers were trained by foreign and native masters in the Imperial ballet schools in St. Petersburg and Moscow. The last was the Italian maestro,

Enrico Checetti, later identified with Anna Pavlova and the Diaghileff Russian Ballet. Russian Ballet in St. Petersburg and Moscow was paramount, and Europe was looking towards it. MICHEL FOKINE, dancer and balletmaster, revealed himself as an innovator. His tendencies have been romantic, lyrical, exotic and hellenic. He strove to shorten the ballet and intensify the drama. His adept colleagues, Pavlova, Karsavina, Fokina, Nijinsky, Bolm and a host of other dancers, follow him. His ballets include *La Vigne*, music by Rubinstein, *Carnaval* by Schumann, *Chopiniana* to music by Chopin, and were considered revolutionary. At the same time ISADORA DUNCAN, the American, appeared in Europe in her mimetic dances—called interpretative—consisting of free movements based on antique sculpture, with also the use of classical music. The Petrograd dancers invited her to appear there in 1907. Her performances were a confirmation of the new tendencies in the Russian ballet.

In 1908 Adolph Bolm presented Anna Pavlova for the first time in Europe, in a series of short ballets and divertissements. Stockholm, Copenhagen, Prague, Berlin acclaimed the dancers—and this can be considered the beginning of the Russian ballet era in Europe. In 1909 Serge Diaghileff assembled a brilliant ballet company from among the dancers of Petrograd and Moscow Imperial ballets—Pavlova, Karsavina, Nijinsky, Bolm, Corali, Koslov, Mordkin and about 50 highly trained dancers in a repertory of ballets staged by Fokine, with sceneries and costumes by Bakst, Benois and Roerich. The first performances in Paris created a sensation. The work of the Diaghileff Ballet can be called a definite period in the history of art and the dance. The most famous ballets created by Fokine are perhaps *Scheherazade*, music by Rimsky-Korsakoff, scenery and costumes by Bakst, *Cleopatra*, by Arensky, costumes and scenery by Bakst, *Thamar*, by Balakirev and Bakst, *Fire Bird*, music by Igor Stravinsky, scenery and costumes by Bakst, *Petroushka* by Stravinsky, scenery and costumes by A. Benois, *Polovetsian Dances*, music by Borodine from the opera, *Prince Igor*, scenery and costumes by N. Roerich, *Carnaval*, by Schumann, orchestrated by Rimsky-Korsakoff, Glazunov, *Spectre de la Rose*, by Weber and Bakst, *Pavillion d'Armide*, Tscherepnine Benois, *Chloë and Daphnis*, by Ravel and Bakst, the opera, *Coq d'Or*, by Rimsky-Korsakoff, scenery and costumes by Natalie Gontcharova, in which the principle of the Japanese "No" drama was employed when the dancers mimed and danced the parts sung by the opera singers.

In *The Afternoon of a Faun*, music by Debussy, scenery and costumes by Bakst, Nijinsky exploited the more archaic, bas-relief Greek style to give the impression of a moving frieze. *Games*, music by Debussy, scenery and costumes by Bakst, was an attempt to introduce stylized sport movements.

*The Rites of Spring*, music by Stravinsky, ballet scenery and costumes by Nicolas Roerich, marked a revolutionary stage of the ballet by its primitive

stamping, stooping, whirling, crawling movements which caused a sensation in Paris in 1913. At this time the Russian Ballet made its triumphal appearance in the capitals of South America.

In the spring and early summer of 1914 the Diaghileff Ballet appeared at the Paris Opera and Covent Garden, at London, in a large repertoire with the already mentioned *Coq d'Or*, Richard Strauss's ballet, *The Legend of Joseph*, Florent Schmitt's *Tragedy of Salome*, staged by Romanoff, scenery and costumes by S. Soudeikine, *Persian Ballet* in the opera, *Khovanchtina*, music by Moussorgsky, staged by Adolph Bolm.

The first appearances in 1915 of the Diaghileff Ballet in New York were again a revelation. A company of more than 60 dancers with Adolph Bolm, Miassine, Gavrillov, Maclezova and Lopoukhova appeared in new dance dramas presented with new music which was conducted by Ansermet and later by Monteux. Nijinsky joined the company in America, where he produced *Till Eulenspiegel*, by Richard Strauss; as a ballet this was his last creation. To the large repertory of the Diaghileff company were added the ballet *Sadko*, set to music by Rimsky-Korsakoff, costumes by N. Gontcharova, staged by Adolph Bolm, and *Midnight Sun* set to music also by Rimsky-Korsakoff, costumes by Larionov and staged by Miassine.

The Diaghileff Ballet continued in Europe until July 1929, when Diaghileff died at Venice, Italy. Adolph Bolm remained in the United States and staged *Coq d'Or* in a new version for the Metropolitan Opera Company in New York, appearing in it as King Dodon from 1917 to 1922. Bolm also produced the first American ballet, *The Birthday of the Infanta*, written by John Alden Carpenter, with costumes and scenery by the American painter, Robert E. Jones, for the Chicago Opera Company in 1919.

From 1917 Leonid Miassine created, in collaboration with noted painters and composers, *Parade*, by Eric Satie, *Tricorne*, by Manuel De Falla, *Chout* and *Pas d'Acier*, by Prokofieff. La Nijinskaya, sister of Nijinsky, also created important ballets, such as *Noces*, by Stravinsky; she was followed by Balanchine whose ballets, of which the most famous are perhaps *Barabou*, *La Chatte* and *Matelots*, present a kaleidoscope of theatrical effects.

ANNA PAVLOVA who, after 1910 returned many times to the United States with a large ballet company, continued the classical traditions of the ballet. She immortalized the classic ballet, her most famous parts being *Giselle*, *Fairydoll*, *Swan* and *Bachanal*.

Other ballet organizations have made significant contributions. The Swedish Ballet Company presented *The Ballets of Ida Rubinstein*. Masterpieces created originally for the Diaghileff Ballet are now presented by many companies in Germany, in Paris, Vienna, Milan and Rome. In Russia, the ballet has been undergoing radical changes and has been used as one of the many mediums of political propaganda.

Ruth St. Denis, Loie Fuller, Laban, Mary Wigman

and the young concert dancers, especially in America, such as Martha Graham, Agnes De Mille, Ruth Page and others, have contributed to the development of the dance. *See also* DANCE.

A. Bo.

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**BALL GAMES**, comprising the group of outdoor and indoor games and sports, played with one or another form of smooth spherical body, may be said to date from earliest man. It is a reasonable assertion that the first human species grasped the inherent sources of pleasure in the ball, embodied in the pebble, rounded rock, coconut, orange, and other spherical objects, and that it evolved a variety of ball games for amusement. Within the span of recorded history, ball games have had a steadily increasing interest for mankind. The Greeks designed a variety of sports around the ball. The Romans, improving upon the comparatively naïve ball games of the Greeks, invented the air-filled leather ball, which gave rise to more complicated sports in which bouncing was an integral part, and a new source of diversion. The origin of the use of an instrument, as the bat, racket, or other implement, to strike the ball is lost to history. This latter innovation, combined with the resilient ball, was the parent of innumerable ball games of to-day.

Games in which the ball is struck with some instrument constitute by far the greatest number, although games in which the ball alone is used provide sport for a great number of people. The first group includes the games and affiliated sports of BASEBALL, indoor and outdoor; BASKETBALL; BILLIARDS; CRICKET; CROQUET; GOLF; HOCKEY; LACROSSE; LAWN TENNIS, with BADMINTON, PING-PONG, and other offshoots; POOL, and POLO. The second group, comprising games employing the ball without or with little other equipment, include BOWLING; FOOTBALL, rugby, soccer and association; HANDBALL; MEDICINE BALL, and PUSHBALL. Most of these ball games have been so developed as to require a special skill for proficiency; likewise many of them have given rise to a distinctive idiom and technical jargon.

**BALLINGER, RICHARD ACHILLES** (1858-1922), American lawyer and judge, was born at Boonesboro, Ia., on July 9, 1858. He was graduated from Williams College in 1884. Admitted to the bar in 1886, he practiced and was city attorney at Kankakee, Ill., and New Decatur, Ala. He then moved to the state of Washington and practiced at Port Townsend in 1889-97 and at Seattle thereafter. He was judge of the superior court of Jefferson Co., Wash., in 1894-97. He was elected mayor of Seattle on a reform ticket in 1904. Ballinger's knowledge of mining law was recognized by Secretary of the Interior Garfield, who appointed him commissioner of the General Land Office in 1907. Retiring after a year's service, he was named Secretary of the Interior in

1909 by President Taft. Ballinger's conduct of his department was attacked by Louis R. Glavis, an official in the Land Office, who was dismissed for insubordination. When Glavis persisted in his charges Congress ordered an investigation by a special committee which completely exonerated Ballinger. But public opinion had been so aroused that President Taft found it politically expedient to accept his Secretary's resignation in Mar. 1911. Ballinger returned to Seattle where he resumed the practice of law until his death on June 6, 1922.

**BALLISTICS.** This topic deals with the problems involved in the throwing or shooting of projectiles, such as rifle bullets, cannon balls and shrapnel shells. The World War made this field of science a very important one. The close proximity of the trenches of the opposing armies made it necessary that every factor in the throwing of projectiles should be taken into account, otherwise an army would find its artillery shelling its own entrenchments instead of the enemy's. There are two special divisions of ballistics, interior and exterior. Interior ballistics is the study of problems connected with a projectile, from the instant of firing until it leaves the muzzle of the gun. Exterior ballistics is concerned with the projectile after it has left the muzzle.

**Interior ballistics** is that division enabling one, given the volume of the powder chamber, the diameter and length of the bore, the weight of the projectile, the weight of charge and the size and shape and composition of the powder grains, to calculate the pressure and velocity throughout the travel of the PROJECTILE until it emerges from the bore. In American guns, powders (*see* EXPLOSIVES) are small cylinders with seven lengthwise perforations. This form of grain gives a nearly constant burning surface until the powder is consumed about the end of the projectile's travel in the bore, and hence it gives a progressive action following up the projectile without producing too great an early maximum pressure. With similar guns the grain size is proportional to the caliber. Working pressures are ordinarily 17 tons or more per sq. in. and muzzle velocities from 2,600 to 3,150 ft. per sec.

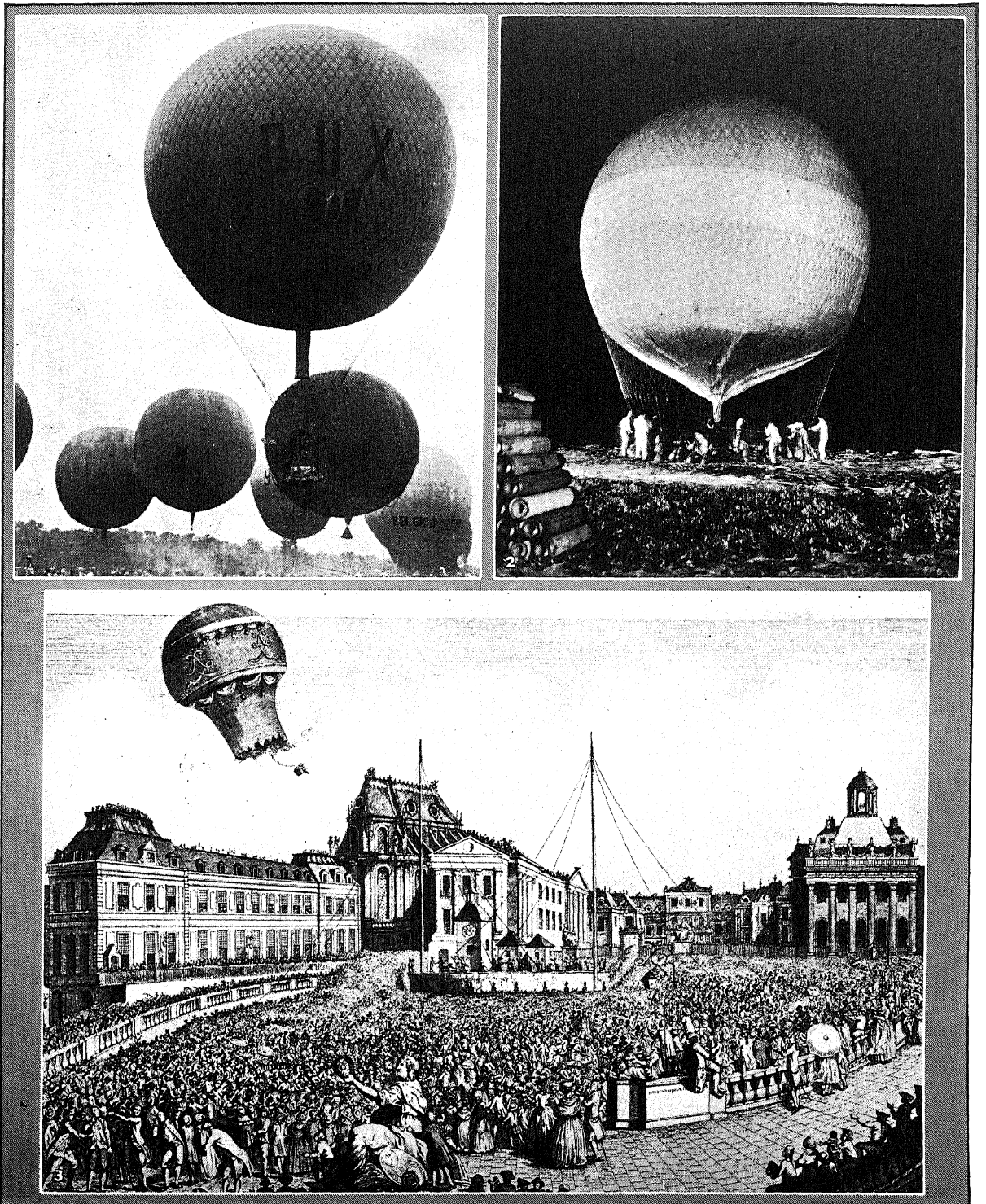
**Exterior ballistics** is that division enabling one, given the projectile's weight, diameter, form and muzzle velocity, to calculate range and other elements of the trajectory for a given elevation angle. Other factors producing calculable effects are wind, speed of target and firing ship, nonstandard density of air and the sidewise drift resulting from the projectile's spin. *See also* MAGNUS EFFECT.

**BALLOON**, a nonrigid type of lighter-than-air craft comprising a bag of impermeable material, which rises when inflated with a gas lighter than air. Below the bag is suspended a basket or car for carrying passengers. In some balloons the airman hangs from a PARACHUTE which may be cut loose for descent.

In 1783 the Montgolfier brothers conceived the principles of the hot air balloon by watching smoke rise in the fireplace. Building a small paper sphere



## BALLOON



1, 2. COURTESY GOODYEAR TIRE AND RUBBER CO.

### NOTABLE BALLOON FLIGHTS, PAST AND PRESENT

1. Entries of the International Balloon Race, Labor Day, 1930. 2. Balloon being filled for ascent. 3. The "Aeronautic Experiment" of M. Montgolfier at Versailles, Sept. 19, 1783 (from a contemporary drawing). In the presence

of the entire royal family, a gaily decorated balloon carrying a sheep, cock and duck ascended and remained aloft several seconds. After a short period, the balloon sank to the earth and the animals stepped out—the first earth creatures to fly.



and inflating it with smoke or heated air, they obtained the first successful balloon ascension. Later experiments showed that HYDROGEN was superior to hot air, making possible longer flights.

The balloon is of little commercial value at present, but it is still used for observation work in military operations, being anchored by a cable. In the Franco-Prussian War, the free balloon was used as a means of egress from the besieged city of Paris. The balloon is also used by scientists in studying the upper strata of the atmosphere. Like the commercially obsolete sailing vessel, the balloon is used by sportsmen, both national and international races being held annually. *See also* BALLOON OPERATION. W. T. V.

**BALLOONING**, the sport of competitive travel in balloons, has a restricted following, due to the increasing interest in other fields of aeronautics. The use of balloons in competition began in 1906, when James Gordon Bennett (1841-1918) established the annual Gordon Bennett Balloon Trophy Race. In 1908 Col. Schaeck, representing Switzerland in the Bennett race, remained aloft 73 hours, and in 1910 the American team, Hawley and Post, established a record flight of 1172.9 miles. But interest in ballooning as a sport was slight, and during the World War there was no contest for the international trophy. In 1919 interest was revived, and there were 10 entries in the National Elimination Balloon Race, now held alternately with the competition for the Bennett prize. In both contests the prize is awarded to the team covering the greatest distance, and the Bennett race is held in the country of the last winner. Since 1920 the Bennett competition has been held in various countries. In 1928 Capt. W. E. Kepner won the third consecutive American victory in the competition, thus giving the United States permanent possession of the trophy. Of the 17 races held for the original trophy, the United States won 7, Belgium 5, Germany 2, Switzerland 2, and France 1. In 1930 the American team of Van Orman and MacCracken won one leg on the second Bennett Trophy, covering a distance of 542 miles.

**BALLOON OPERATION.** The altitude of a free BALLOON is controlled by permitting gas to escape through valves, causing the balloon to descend, or by discharging ballast, allowing it to rise. Alterations in bouyancy due to temperature changes in the gas of a balloon are compensated for by these same methods. Direction may be varied by the selection of different air currents; usually there exists a variation of 45°, and occasionally as much as 180°, in the direction of currents in different strata of the atmosphere. The instruments used in balloon operation include: CLIMB INDICATORS, COMPASSES, THERMOMETERS, SEXTANTS and radio receivers. *See also* AERIAL NAVIGATION.

W. T. V.

**BALLOON-VINE** (*Cardiospermum Halicacabum*), called also heart-seed, a climbing, much-branched herb of the soapberry family. Native to warm regions, it is now widely planted as an ornamental in mild climates and has run wild in the southeastern United States. It climbs to a height of 10 ft., bear-

ing much-divided leaves and slightly irregular white flowers. The somewhat pea-like black seeds, borne in bladder-like pods, are strikingly marked with a white heart-shaped spot.

**BALLOT**, originally a system of voting by use of differently colored pellets or balls; hence the name from French *balla* meaning ball. In modern voting, the word is usually applied to a written or printed paper on which the preferences and decisions of the voter are indicated.

**BALLOU, HOSEA** (1771-1852), American clergyman, one of the founders of Universalism, was born in Richmond, N.H., Apr. 30, 1771. He was expelled from his father's church for declaring his belief in universal salvation. During his 35-years' pastorate of the Second Universalist Church, Boston, he preached over 10,000 unwritten sermons. He died at Boston, June 7, 1852.

**BALL'S BLUFF, BATTLE OF**, Oct. 21, 1861, a minor engagement of the CIVIL WAR in Virginia. Gen. McClellan, preoccupied in drilling and organizing the Army of the Potomac, ordered Gen. Stone to conduct a demonstration against the Confederate force at Leesburg. Stone, not understanding that McClellan intended no definite assault, led a force of 2,100 across the Potomac, and at the eminence of Ball's Bluff encountered a Confederate force of 5,000 under Evans. Entrapped between the bluff and the river, the Unionists were badly defeated, suffering about 1,000 casualties. The Confederates lost 302 men.

**BALLSTON SPA**, a village in eastern New York, the county seat of Saratoga Co. It is situated 7 mi. south of Saratoga Springs and is served by bus lines and the Delaware and Hudson Railroad. The village is in the Adirondack Mountains, near the Saratoga County Springs Reservation, and because of its valuable mineral springs, has become a popular health resort. Garden crops are produced extensively. It is the seat of the Saratoga County law library. Ballston Spa was founded in 1763 and incorporated in 1807. Pop. 1920, 4,103; 1930, 4,591.

**BALMACEDA, JUAN MANUEL** (1840-91), Chilean statesman, born July 19, 1840 of a distinguished and well-to-do family in Santiago. He was educated in the Seminario Conciliar of Santiago and began his public life in 1864 as secretary to Manuel Montt. (*See* MONTT, MANUEL.) He served after 1881 as foreign minister and minister of the interior. Liberal laws such as civil marriage were sponsored by him. In 1886 he was the successful candidate of the liberal, radical and national parties. The income from the nitrate fields was so great that Balmaceda was able to spend prodigal amounts in public works and a ministry of public works was organized as a result. Much attention was given to education, financial reforms and labor problems. As the result of a more liberal electoral law Balmaceda had introduced, the opposition achieved a majority in congress. This majority established itself as a monitor over the expenditures of the executive and a quarrel between the

two over the budget led to the first civil war since 1833. Balmaceda was defeated and forced to take refuge in the Argentine consulate. On Sept. 18, 1891, the last day of his term of office, he shot himself.

**BALM OF GILEAD**, in the Old World the name given to a small tree (*Commiphora Opobalsamum*) of the bursera family yielding a fragrant gum resin which was highly prized in ancient medicine. In North America, a kind of poplar (*Populus canadensis*), with large, resinous, very aromatic buds, is known as balm of Gilead. See also POPLAR.

**BALMONT, KONSTANTIN D.** (1867- ), Russian poet, was born in the Vladimir province, Central Russia, June 3, 1867. He is a symbolist and founded, with Bryusov, the Russian modernist school of poetry. Some of Balmont's best known volumes of poetry are *Under Northern Skies*, *Silence*, *Burning Buildings*, *Let Us Be Like the Sun*, *The Flame Bird* and *Mirage*. Balmont translated much poetry from other languages, including works of Shelley, Poe, Whitman, Ibsen and Calderon and also from German, Polish and Sanskrit.

**BALMORAL CASTLE**, the Highland home of British royalty, in Aberdeenshire, Scotland, located on the River Dee about 47 mi. southwest of Aberdeen, and 74 mi. north of Edinburgh. The baronial castle is built of Scottish granite. Backed by Craig Gowan, Balmoral has a fine view of the surrounding countryside. The castle was acquired by purchase about 1850 by the Prince Consort, and bequeathed to Queen Victoria and her heirs.

**BALUCHI**, an Iranian language of the INDO-IRANIAN linguistic group of INDO-EUROPEAN, spoken in Persian and British Balochistan and in Baloch colonies (Afghanistan and Russian Turkestan). As the Baloches formerly lived much further to the northwest, their language which falls into two main dialects has more in common with KURDISH than with AFGHAN. Typical of Baluchi are initial *gv* instead of Persian *b*, as *gvād* — *bād* "wind" (Avesta *vāta*); and an infinitive in *-ag*, as *kanag* "to do." V. M.

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**BALSA** (*Ochroma Lagopus* and others), called also corkwood, trees of the bombax family growing in South America and the West Indies. They attain a height of about 40 ft. and somewhat resemble the North American COTTONWOOD. Well-seasoned balsa wood, twice as buoyant as cork, is the lightest wood known. For hundreds of years natives of South America have used it in boats and rafts. Balsa wood is now employed in making life-preservers and floats for life lines. The wood also has great resiliency and shock-absorbing power; rendering it especially suitable for packing fine furniture and the like. Its high insulating properties make it a useful lining for refrigerators, incubators and cold-storage rooms.

**BALSAM APPLE** (*Momordica Balsamina*), a high-climbing annual, vine of the Gourd family

planted in mild climates as a covering for arbors and porches. It is native to the Old World tropics. The very slender, smooth stems, climbing by means of unbranched tendrils, bear thin, three- to five-lobed leaves, yellowish flowers, usually with a darker center, and handsome orange-colored, irregularly oblong, warty fruits that soon split.

**BALSAM OF PERU**, a true balsam containing both benzoic and cinnamic acids in addition to resin and essential oil. It is a thick, viscid, dark brown or black substance, with a pleasant balsamic odor. The tree (*Myroxylon Periera*) from which it comes is a lofty member of the pea family grown in Central America and Ceylon. Balsam of Peru is used in the manufacture of perfumes and soaps and to some extent, although it has no special medicinal properties, in pharmaceuticals.

**BALSAM OF TOLU**, a true balsam produced by the tropical American tree (*Myroxylon toluifera*) of the pea family, closely allied to the tree from which BALSAM OF PERU is taken. Balsam of Tolu is a brown substance somewhat thicker than Peru balsam, becoming more or less solid with age. Its pleasant flavor and fragrance make it a useful constituent of perfumery, cough syrups and lozenges.

**BALTIC LANGUAGES**, an INDO-EUROPEAN linguistic stock of the *satem*-group (see SATEM-LANGUAGES), comprising Lithuanian, Lettish, the extinct Old Prussian and Kuronian (see also separate articles on these subjects), and the dialects of several other tribes (Jatwings or Sudavians, Zemgals, Seli, and Golyads), the group being so closely akin to SLAVIC that the two are frequently classed together as Balto-Slavic. The original home of the Baltic peoples was to the east of the present area of Lithuanian speech, their westward migrations having taken place in the 6th or 7th century A.D. A. SE.

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**BALTIC SEA**, the great inland sea of northeastern Europe, bordered by Denmark, Germany, Sweden and Russia, and covering an area of about 160,000 sq. mi. Its greatest length is nearly 1,000 mi.; greatest breadth, about 4,000 mi.; estimated length of coastline, 5,000 mi. The greatest depth that has been sounded is 216 fathoms, in a small depression east of the island of Gotland, and the sea's mean depth is only about 36 fathoms. The Aland Islands divide the southern part of the sea from the northern or Gulf of Bothnia. The Gulf of Finland on the east separates Finland from Esthonia. The other principal inland extensions are the gulfs of Riga and Danzig. The Baltic is connected with the North Sea by the Eider; and by a channel passing between Norway and Sweden on the north, and the Jutland Peninsula of Denmark on the south. The famous Kiel Canal is an artificial line of communication between the Baltic and the North Sea.

The chief ports on the Baltic are Copenhagen, Danzig, Memel, Riga and Stockholm. Because of the shallowness and comparative freshness of the water

the surface of the Baltic freezes readily, and many ports are icebound for at least a third of the year. During frosts of exceptional severity the entire surface of the Baltic has been frozen.

**BALTIMORE, GEORGE CALVERT**, First Baron (c. 1580-1632), English statesman and American colonist, was born at Kipling, Yorkshire and received his education at Oxford. His support of James I's project of a Spanish marriage made him unpopular in the House of Commons; in 1625 he resigned, announced his Roman Catholic beliefs and was made Lord Baltimore of Baltimore. He established a colony at Ferryland, Newfoundland in 1621. Finding the climate unsuitable he applied for a grant of land in northern Virginia, now Maryland, but he died before the charter had passed the great seal, and it was issued in the name of his son Cecil in 1632. He is supposed to have written *An Answer to Tom Tell-Troth* and his letters are found in the Clarendon and other state papers. He died April 15, 1632.

**BALTIMORE**, principal city and port of entry of Maryland, advantageously situated at the tide-water head of the Patapsco River, one of the estuaries of Chesapeake Bay. It is at 39° 17' N. lat. and 76° 37' W. long., and is 180 mi. by ship channel from the Atlantic, 38 mi. northeast of Washington and 97 mi. southwest of Philadelphia. Baltimore is the head of shipping on the Atlantic seaboard south of New York, and in 1930 ranked 2nd in volume of imports. In 1920 the population was 733,826; in 1930, 804,874, or 49% of the state population, making Baltimore the 8th largest city in the United States. The city covers an area of 91.93 sq. mi., of which 78.72 sq. mi. are land. In January the average temperature at Baltimore is 34° F., in July 77° F. The average annual precipitation is 42.6 in.

**Geographic Setting.** Baltimore is about 12 mi. from north to south, and 9 mi. from east to west. The navigable portion of the Patapsco River is 12 mi. long and has a maximum width of 3 mi.; it extends northwesterly from Chesapeake Bay up to the city peninsula on which Ft. McHenry is built. The peninsula forms a landlocked harbor, the so-called Northwest Branch, which extends up to the Basin, the main inner harbor; on the other side of the peninsula is Middle Branch. The spacious harbor artificially deepened contributes to Baltimore's importance as a port. Baltimore is on the "fall line"; a short distance in from the deeply indented water front the ground gradually rises, and 1 mi. inland reaches an altitude of between 100 and 200 ft. above sea level.

**Streets and Buildings.** In the main the streets are laid out on the vertical and horizontal axes of the compass. In 1930 Baltimore had 935 mi. of streets. The important thoroughfares are Baltimore Street, dividing the city north and south, and Lexington Street, both cutting the business section which is directly north of the Basin, close to the water front; Charles Street, dividing Baltimore east and west, extends north from the Middle Branch 2 mi. south of the business district, to the city limits on the north.

Modern structures of moderate height are grouped in the business section. The chief public buildings are grouped in a plaza lying between Lexington and Fayette streets directly east of Charles Street. At the east end of this space is City Hall, built of Maryland white marble in Renaissance style and erected at a cost of \$2,753,003. In the center of the square the new Post-Office, which also houses the Federal Courts, also is Italianate in architectural treatment. The Custom House, a few blocks southeast of the Post-Office, is of classic design, constructed of Maryland granite at a cost of \$1,500,000. Wide boulevards lined with trees, among them Fremont, North, and Pennsylvania avenues, cut the city diagonally from southeast to northwest and lead to Druid Hill Park. Besides the public buildings the more noteworthy structures of Baltimore include the new group of buildings of the Johns Hopkins Hospital on North Broadway east of the business district; the First Presbyterian Church, with a Gothic spire 300 ft. high, on Madison Street; the Roman Catholic Cathedral, a Grecian-Ionic edifice, with a dome 231 ft. in circumference; the Enoch Pratt Library, Walters Art Gallery and the Masonic Temple.

**Parks and Monuments.** Baltimore has 26 parks. Druid Hill Park in the northwest section of Baltimore covers 674.16 acres and is one of the most beautiful municipal recreation grounds in the United States. Other grounds are Clifton Park, Carroll Park, Riverside Park and Patterson Park in the southeastern section of the city. The total park area in 1930 was about 3,500 acres. Near the head of Druid Lake is a statue of heroic proportions in memory of Sir William Wallace. The first monument in the nation to commemorate the name of Washington was erected in 1815 in Baltimore, at the intersection of Charles and Monument streets, in the form of a Doric marble column 180 ft. high, topped by a statue of Washington. The "Battle Monument" in Monument Square consists of a column, 52½ ft. high, bearing the names of those who fell in the battle of North Point, 1814. A monument to Francis Scott Key, who composed *The Star-Spangled Banner* during the bombardment of Ft. McHenry, stands at Eutaw Place and Lanvale Street.

**Educational Institutions.** The chief educational institutions of Baltimore are Johns Hopkins University, the Peabody Institute, University of Maryland, and Goucher College for Women.

**Transportation.** In 1930 Baltimore was the 3rd port in the United States in foreign tonnage, a total of 17,114,218 short tons of goods passing through Baltimore Harbor. Foreign imports reached a value of \$111,195,456; foreign exports, \$66,536,775. Most of the imports were ores and metals, nonmetallic minerals such as petroleum and petroleum products, pulp-wood and wood pulp, sugar and fertilizing materials. Coal and coke, wheat, and iron and steel manufactures are the leading exports. Canadian merchandise totalling a value of \$5,935,019 was exported through Baltimore in 1930. Coastwise and internal receipts and shipments

and considerable local tonnage make up the remainder of the huge amount of traffic passing through the harbor. Its extensive pier facilities serve 58 foreign and coastal steamship lines. In 1930 the upper harbor was equipped with 10 municipal piers, and there were 10 shipbuilding and repair plants and 27 water front warehouses. The Delaware and Chesapeake Ship Canal a few miles north gives Baltimore direct water communication with Philadelphia. The city is served by the Baltimore and Ohio, Pennsylvania, Maryland and Pennsylvania and the Western Maryland railroads and by an electric interurban line. There are three electrified railroad tunnels beneath the city. The new Municipal Airport, under construction on the water front, Curtis Airport, Martin Airport and Logan Field are used by the aviation lines connecting Baltimore by air with all parts of the nation. Within the city transportation is provided by the street railway system.

**Industry and Commerce.** The chief manufactures of Baltimore are clothing, copper products, meats, sugar, foundry and machine work, tinware, fertilizers, and chemical and pharmaceutical products. Some of the larger plants located here are the Bethlehem Steel Co., United States Industrial Alcohol Co., Tin Decorating Co., Western Electric Co., Baltimore Copper Smelting and Rolling Co., Davison Chemical Co., Glenn L. Martin Co., and a number of large oil refineries. In 1930 Baltimore's water borne exports amounted to 971,408 long tons, and imports 5,502,644 long tons. In 1929 the manufactures were valued at approximately \$800,000,000; the retail trade amounted to \$380,450,518 and the wholesale trade proper, to \$333,751,337. In 1929 the value of the wholesale trade in Baltimore, all establishments, reached approximately \$651,384,852.

Like Philadelphia, Baltimore combines the advantages of being a seaport and a railway center; these factors aid in receiving coal and raw materials and facilitate marketing of manufactured goods by train and by boat.

**History.** The first settlement on the Baltimore site occurred in 1662, when Charles Gorsuch, a Quaker, obtained title to 50 acres on what was then Whetstone Point. In 1730 by authority of the General Assembly, Baltimore Town was laid out on the north side of the Patapsco River. The town grew rapidly in shipping importance and increased in size by a succession of annexations. In 1796 Baltimore was incorporated as a city. During the War of 1812 Baltimore shipmasters preyed damagingly on the British fleet. The first blood in the Civil War was shed in Baltimore in 1861, in a riot between the citizens and Union soldiers. In 1904 the business section was totally destroyed by fire which did damage to the extent of \$125,000,000.

**BALTIMORE, UNIVERSITY OF,** Baltimore, Md., a coeducational institution organized in 1925. It includes schools of Letters and Social Sciences, Law and Business Administration and Day and Evening divisions. The library contains 8,461 books.

The total assets in 1931 amounted to \$196,000. In 1931-32, there were 900 students and a faculty of 72 members headed by Pres. Howell A. King.

**BALUCHISTAN**, a country in the south central part of Asia, lying south of Afghanistan and extending to the Persian Gulf from 25° to 32° N. lat., and from 61° to 70° 30' E. long. Area 134,638 sq. mi.; pop. 1931, 867,211.

Baluchistan is composed of British Baluchistan proper (tracts assigned to the British government by treaty in 1879), covering 9,096 sq. mi.; Agency Territories directly under British officers, 45,132 sq. mi.; and the Indian states of Kalat and Las Bela, 80,410 sq. mi. The towns, Quetta and Sibi, are of British origin. Quetta, at the head of Bolan Pass, holds a strategic position. The majority of the inhabitants are nomadic and belong to three principal races, the Brahuis, Balochi (or Biluchi) and Pathans, speaking different languages.

Great Britain has played an important part in Baluchistan since 1839. British Baluchistan and the Agency Territories are administered by a chief commissioner who resides at Quetta. He is directed by the governor-general of India. The native state of Kalat is governed by a *wali*, or head of a confederacy of chiefs, who is under the control of a British political agent; the other state, Las Bela, has a native chief who is also controlled by the agent.

The general surface of the country is mountainous, some peaks reaching 6,000 ft., with deserts and stony plains. There are no large rivers that can be used for irrigation; the rivers are short, rushing torrents which flow after rain. The climate is subject to the extremes of heat and cold, and the rainfall is uncertain and scanty. In some of the valleys and plains the soil is fertile, producing chiefly millet, wheat, barley, rice and lucerne. Dates, grapes, apricots, olives, peaches, apples and melons are successfully grown.

**BALUSTER AND BALUSTRADE.** A baluster is one of the small rounded, turned or molded posts supporting a railing. The entire combination of the posts with the cap or rail they support is known as a balustrade. Hence, balustrade is sometimes loosely and incorrectly used for any pierced parapet or railing. Although successions of colonnettes were used by the Gothic builders to support railings, the true molded baluster was an invention of the Italian Renaissance. The earlier examples, appearing first towards the end of the 15th century, were of the double-vase type, in which two reversed vase or candelabrum shapes were united in the middle by a molding. The top and bottom were often molded with profiles resembling the Doric capital. In some cases the balusters were decorated with leaves and flutings. The single vase type is naturally heavier in proportion to its height. Its first known use was in the work of Vignola (1507-73); from then on it be-

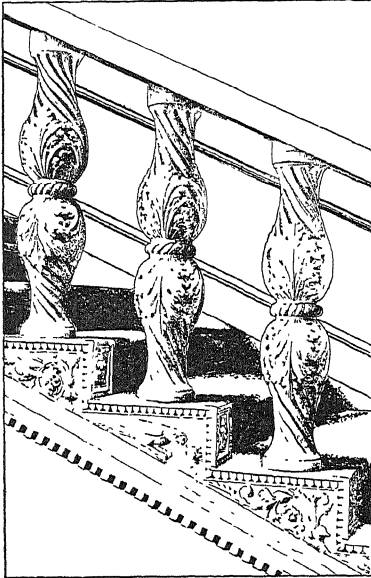


BALUSTRADE OF A  
ROMAN HOUSE  
BUILT BY FEDER-  
ICO ZUCCANI  
Late 16th century



came increasingly popular and was used in many balustrades.

Balustrades are important features of the terraces and stairs of villas, and were developed as the crowning motives of buildings, above the cornice. The typical Renaissance balustrade consisted of the molded



BALUSTERS AND BALUSTRADE FROM THE STAIRCASE IN THE GONDI PALACE, FLORENCE

Designed by Giuliano San Gallo

railing, heavy end or corner pieces, known as dies, which often served as the pedestals for urns or statues, the balusters themselves, and frequent smaller square posts or dies, dividing the balusters into rhythmical groups. In the Baroque period square balusters became common, and all sorts of the most fantastic types of molding. Occasionally alternate balusters are reversed end for end, the bottom of one resembling the top of the next. Heavy variations of the baluster form are found in Louis XIVth and English Jacobean work. In the 17th and 18th centuries baluster shapes were frequently used as legs for furniture.

**BALZAC, HONORÉ DE** (1799-1850), French novelist, was born at Tours, May 20, 1799. His father was a peasant who had made his way into the bourgeoisie, his mother an heiress of considerable wit and charm, and much of Balzac's success in handling widely diverse types of character is easily traceable to this variegated ancestry. He was trained for the law, but abandoned it for writing soon after he had finished his education. Throughout his twenties he was groping for his true material and its proper form, producing in the process a number of melodramatic novels and a few dramas to which he would not even set his name. At 25 he embarked on a visionary and catastrophic publishing venture, which hampered his writing, turned him temporarily into a fugitive and handicapped him financially during his entire

middle period. In 1829, however, he produced *Les Chouans*, a novel of the Revolution, which, although it was faulty and uneven, was of great importance; in French letters it was the transitional book which bridged the gap between historical romances and the novel of contemporary manners, and in Balzac's own life it was the overture to his tremendous *COMÉDIE HUMAINE*.

Early in his thirties Balzac had conceived and embarked on his plan of recording every aspect of the French life of his period in a series of novels, novellettes and treatises. His project involved the writing of 150 books and pamphlets, and in the less than 20 years that remained to him, he did actually, by virtue of his prodigious vitality and self-discipline, complete 95 items of his superhuman task. These books include many of the indubitable masterpieces of literature, among them *Eugénie Grandet*, 1833; *Le Père Goriot*, 1834; *La Recherche de l'absolu*, 1834; *Une Ténébreuse Affaire*, 1841; *La Cousine Bette*, 1846, and *Le Cousin Pons*, 1847.

Physically gross to the point of the grotesque, Balzac was charming and almost childishly amiable, the friend of most of the great and eccentric men of his day. He had a series of enduring friendships with women, and the story of his lifelong devotion and belated marriage to the Polish Madame Hanska has been told and retold. In literature his importance can hardly be overrated. He was a romantic in both the Gothic and realistic styles, and his influence can be seen in the literature of every occidental nation. His own work was epic in scope and conception, its excellence varied from book to book, and even within his real masterpieces he is still imperfect; partly, no doubt, because of the haste with which he wrote, but more fundamentally because of some deep flaw in discrimination. Balzac died in Paris, Aug. 17, 1850. See also FRENCH LITERATURE.

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**BALZAC, JEAN LOUIS GUEZ DE** (c. 1597-1654), French prose writer, was born at Angoulême in 1597. He was a favorite of Cardinal Richelieu, a member of the French Academy, a councilor of state and historiographer. His *Lettres* have been generally admired. His other works are *Le Prince*, *Discours*, *Le Barbon* and *Aristippe*. Balzac died at Angoulême, Feb. 18, 1654.

**BAMBERG**, the principal city in Upper Franconia, Bavaria, situated on the Regnitz River near its junction with the Main River, about 32 mi. north and west of Nürnberg. It was formerly the capital of the bishopric of Bamberg. The city is partly in a valley and partly in an amphitheater of seven hills. On one of the hills is the Cathedral of St. Peter and St. George, one of the best examples of late-Romanesque and early-Gothic architecture. The cathedral was founded in 1004 by Henry II, and was burned and rebuilt in the 13th century. It contains the only

grave of a Pope in Germany, that of Clement II. Among a number of other interesting buildings are the Baroque St. Martin's Church and the State Library, originated from the libraries of the Jesuits and containing 400,000 volumes, 3,400 incunabula, 4,500 manuscripts, 30,000 drawings and valuable paintings and etchings. The city is an important transshipment port, being located on the canal which connects the Main and the Danube rivers. It has several industries, including breweries, cotton spinning mills and boot and shoe factories. The earliest record of Bamberg dates from 973. It is now the seat of an archbishop and of the Court of Appeal. Pop. 1925, 50,152.

**BAMBINO, IL**, the Italian name for an image of the infant Jesus. The most famous bambino was carved from the wood of the olive trees in Gethsemane by a member of the Franciscan order in the 15th century, and brought to the Church of the Friars Minor on the Capitoline Hill where it was solemnly crowned by the Vatican chapter on May 2, 1897. It is adorned with a great wealth of jewelry.

**BAMBOO** (*Bambusa* and other genera), the common name of many tree-like GRASSES. They are widely distributed, chiefly in the tropical and subtropical parts of Asia, Africa and America, where they are found from sea level to an altitude of 15,000 feet. Many of them attain great size, sometimes 100 feet in height and a foot in thickness. All have jointed rootstalks from which rise numerous, usually erect, straight stems attaining their full height unbranched and then sending out dense masses of horizontal branches. The jointed stems, generally of rapid growth, are very hard, due to a silicious external covering, hollow and light.

The best known is the common or feathery bamboo (*B. vulgaris*), probably native to Java and very widely cultivated. Its many smooth branches rising from a bright green stem bear large oval leaves and small flowers clustered at the joints. Bamboos are of great economic value, being extensively used in the East Indies and southeastern Asia in making houses, furniture, bridges, water pipes, paper, cordage, baskets, mats, pipe stems and a multitude of other articles. The seeds and young shoots are a common food; the leaves make excellent fodder for cattle.

Several bamboos have been naturalized in California, Louisiana, and Florida; the more hardy are adapted for landscape gardening.

**BANANA**, one of the largest of perennial herbs, often 30 ft. high, native to the tropics but cultivated in sub-tropical countries, as far north as Bermuda for ornament or for its fruit. About 70 species together with more than 200 varieties constitute the genus *Musa*, the type genus of the banana family. Of these the most important are the common banana (*Musa sapientum*), the fruits of which are generally eaten raw, and the plantain (*M. paradisiaca*), bearing fruit that is always cooked before being eaten. The erect stems, rising from perennial rootstocks, produce huge drooping flower buds with large overlapping, purple,

leafy bracts. These rise successively and, after exposing the flowers beneath them, soon fall off. The individual flowers in turn drop their outer parts and the ovaries at the bases of the pistils swell and become yellow or red bananas. When the fruit has ripened the stems become weak and die. New stems, however, appear from the bases of the old ones and continue the process indefinitely.

The intrinsic qualities of the banana have made it one of the most important of fruits used by man, not only in the tropics but in climates where the plants cannot be grown because of frost. Among these qualities are cheapness of cultivation as indicated by its natural method of reproduction; ease of handling and transportation, the fruit clusters being gathered while still immature and shipped long distances; long keeping qualities, the green fruit often being held in storage for two or three months, ripened with artificial heat and exposed for sale during several weeks without deterioration; and adaptability to many culinary purposes. It may be eaten raw as in salads, cakes, ice creams and other desserts, or cooked in various ways.

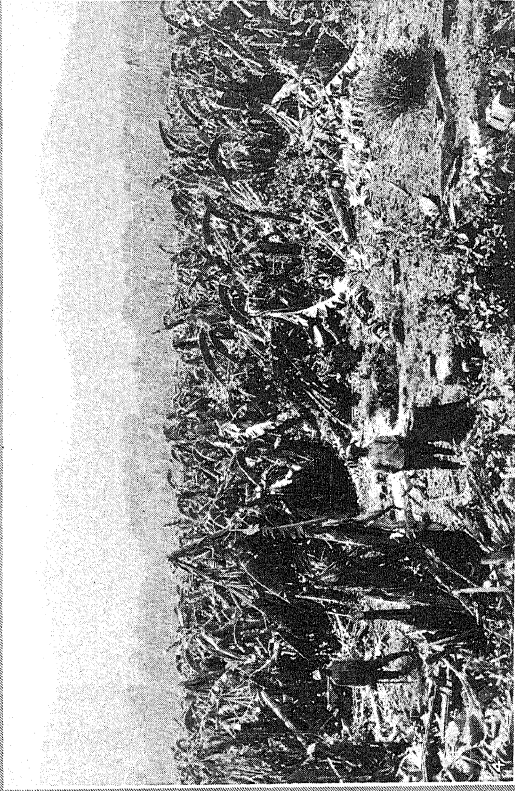
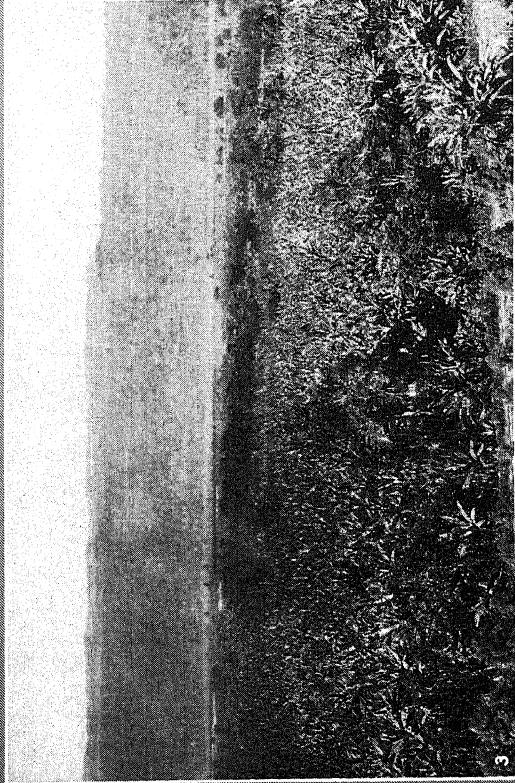
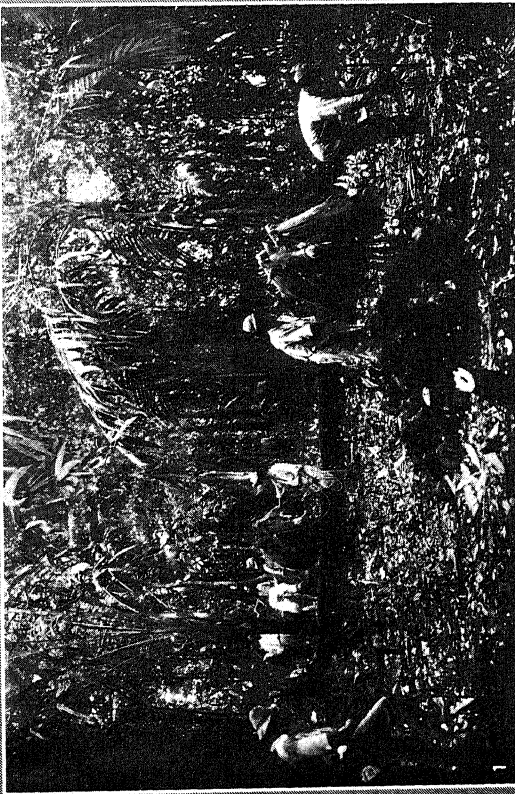
The sources of the banana supply for the United States are Cuba, Jamaica, Costa Rica, Honduras, Central America and Colombia. They are also grown in a small way in California, Florida and Louisiana. To start a plantation sucker plants are cut from the parent plants with a spade when about 3 ft. high and transplanted deeply in rich soil about 10 ft. apart so their broad leaves will shade the soil. In about two years the plants begin to bear.

M. G. K.

**BANBURY**, a market town of Oxfordshire, England, situated on the River Cherwell and the Oxford Canal, in the heart of a rich agricultural district, 67 mi. northwest of London. Banbury is famous for its cross of nursery rhyme fame, and its currant cakes that still are sold in a shop dating from 1616. The cross, destroyed by zealous Puritans in 1610, has an ornate, modern substitute. A splendid Gothic church destroyed in 1790 has been replaced by an inferior structure. There remain, however, several fine timbered and gabled houses of the 15th and 16th centuries. Banbury has breweries, manufactures of agricultural implements and rope and leather works. Pop. 1921, 13,340; 1931, 13,953.

**BANCROFT, GEORGE** (1800-91), American historian and diplomat, was born at Worcester, Mass., Oct. 3, 1800. Entering Harvard at 13, he was graduated at 17, and later studied at Gottingen and Berlin, where he attended the lectures of Schleiermacher and Hegel. From the German metaphysicians, he acquired the philosophy of democratic idealism which formed the basis of his historical and political thought. Returning to America, he became tutor of Greek at Harvard and in 1823, with J. G. Cogswell, he founded the famous Round Hill School at Northampton. He was collector of the port of Boston 1838-41, and in 1844 was unsuccessful Democratic candidate for governor of Massachusetts. As Secretary of the Navy under Polk, he established the Naval Academy at Annapolis in 1845, and the

# BANANA

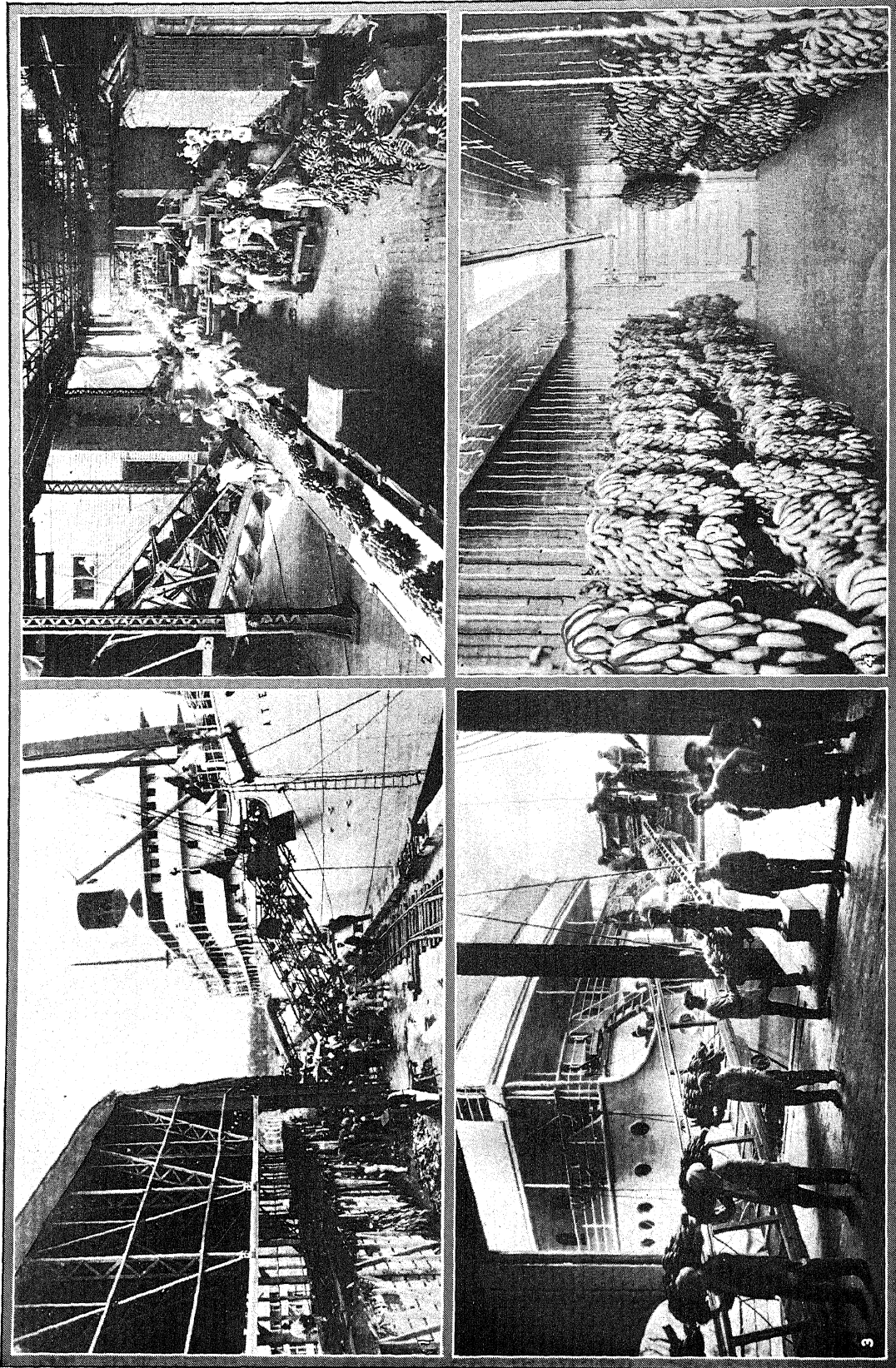


## SCENES ON A BANANA PLANTATION IN COSTA RICA

1. Underbrushing, lining and planting bananas.
2. Cross section of the "trunk" of a banana plant.
3. A vast tropical banana field.
4. A "blow-down," showing havoc wrought by heavy winds.



# BANANA



## BANANAS IN TRANSPORTATION

1. Loading the banana steamship at a tropical port. 2. Unloading bananas at the port of New Orleans.
3. Elevators and conveyors delivering fruit from well deck to pier. 4. Room for the artificial ripening of bananas.

next year Polk appointed him minister to England. From 1867-74 he was U.S. minister at Berlin. His diplomatic career was distinguished by his work in the settlement of the naturalization question and the northwest boundary dispute with England.

Bancroft's chief literary work was his monumental *History of the United States, from the Discovery of the American Continent*, which appeared originally in ten volumes, 1834-74. Its author was equipped with a wide knowledge of original documents, a love for his subject, and an unshaken belief that the democratic institutions of his country were guided by a divine Providence. Written in the period of "romantic nationalism" in American history, it contains all the virtues and defects of that school. Although frequently marred by pomposity of style and extreme bias, it was for many years the most popular work of its kind in America. Modern historians consider it antedated. Bancroft's other works include *Literary and Historical Miscellanies*; *Martin Van Buren*; and a number of published speeches. He died at Washington, D.C., Jan. 17, 1891.

**BANCROFT, HUBERT HOWE** (1832-1918), American historian, was born at Granville, Ohio, May 5, 1832. He sold books in Buffalo and in 1852 established a large publishing and mercantile firm in San Francisco. Here he gathered together a remarkable collection of historical material relating to the Pacific slope. From these, with the aid of a large staff of research workers and scholars, he prepared his monumental *History of the Pacific States*, published in 1875-87, covering the Pacific coast from Alaska to Mexico. The major portion of this work, which totaled 39 volumes, was written by Bancroft's assistants, his own part being that of editor rather than author. His later publications, largely autobiographical and reminiscent in character, include *Literary Industries*, 1890, *Retrospection, Political and Personal*, 1912, and *In These Latter Days*, 1917. He died at San Francisco, Mar. 2, 1918.

**BANCROFT, WILDER DWIGHT** (1867- ), American chemist, was born in Middletown, R.I., Oct. 1, 1867. He was graduated from Harvard in 1888 and in 1902 obtained a Ph.D. at Leipzig. In 1896 Bancroft founded the *Journal of Physical Chemistry* and has been its editor since. Besides having been president of the American Electro-Chemical Society, in 1905, and of the American Chemical Society, in 1910, he has been a member of many other American scientific bodies.

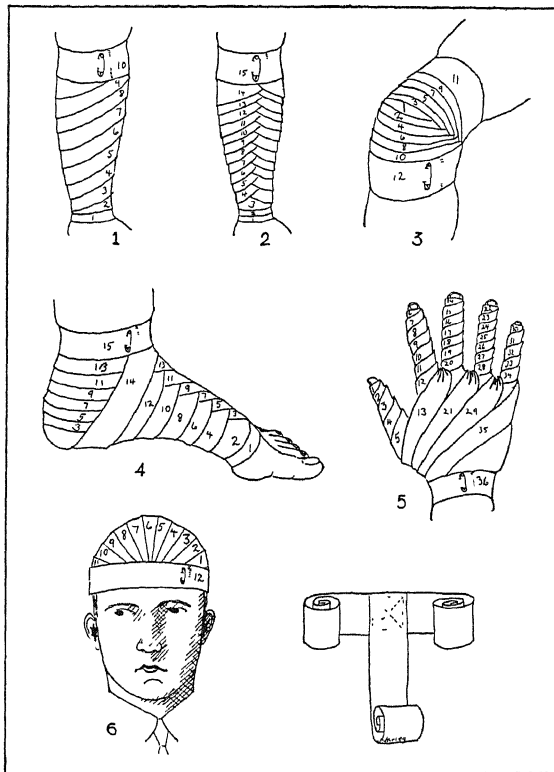
**BAND, MILITARY.** See MILITARY BAND.

**BANDAGES AND BANDAGING.** A bandage is a piece of cloth or other material, varying in shape and size, which is applied to a limb or other part of the body to make pressure and stop bleeding. It may be used to prevent movement of a part or to hold sterile dressings in place.

The various types of bandage are named after their form, their method of application, or their designers.

A *roller bandage* is a long strip of gauze wound for convenience into a roll. On account of its wide useful-

ness, the modes of application of this type constitute the more considerable part of the art of bandaging. In bandaging a tapering member, as the forearm, the bandage may be begun at the smaller end of the portion to be bandaged. This produces a smoother effect than otherwise (Fig. 1). If a member tapers too rapidly to produce a smooth effect by such a procedure, the bandage may be reversed so that alternate surfaces are in contact with the member at successive turns (Fig. 2).



TYPES OF BANDAGES

1, Spiral bandage; 2, spiral reverse; 3, figure-of-eight bandage of knee; 4, spica bandage of foot; 5, gauntlet; 6, recurrent bandage of head; 7, "T" bandage

A bandage may be applied over a bent joint, as the knee, by winding it in a figure-of-eight pattern. This method is elucidated by Fig. 3.

The spica bandage effects a firm dressing of a member by alternating turns about the member and a larger portion of the body continuous with it. Such combinations are foot and leg (Fig. 4), thumb and hand (Fig. 5), thigh and trunk.

A variety of special arrangements are utilized in applying roller bandages to the scalp (Fig. 6), eye, or jaw.

Other shapes of bandages are: the T-bandage (Fig. 7), useful in holding dressings on the perineum; also the triangular bandage efficient as a sling and for wrapping the head, foot, and hand. This type is made of a large square of muslin folded diagonally.

**BANDA ISLANDS**, a group of the Dutch East Indies, in the Banda Sea, forming part of the resi-

dency of Amboina. They comprise an area of about 19 sq. mi. They are nearly all of volcanic origin. The soil is favorable to the cultivation of nutmeg and spices. Vanilla, coconuts and tapioca are also produced. Banda Neira is the capital and largest town. The islands were occupied by the Portuguese in the beginning of the 16th century but passed to the Dutch about 200 years later. Est. pop. 1931, 10,000.

**BANDELIER NATIONAL MONUMENT**, a tract of land 22,075 acres in extent in north central New Mexico containing ruins of prehistoric cliff dwellings. The region was set aside as a government reservation, Feb. 11, 1916, and is administered by the Department of Agriculture. The monument is named in honor of A. F. Bandelier, who, in 1890, with Charles F. Lummis, discovered the ruins of the cliff dwellings and the remarkable communal house in Frijoles Canyon. Extensive ruins of Otowi, Tsankawi and other cities in addition to those in Frijoles Canyon, are included in this monument. In some of the dwellings, the tools, implements and simple household equipment have been restored as they were ages ago.

The monument is approximately 50 mi. west of Santa Fé, N.M. over a good dirt road. Santa Fé is on the U.S. Interstate Highways, the Denver and Rio Grande Western Railway and a spur of the Santa Fé system which comes up from the main line at Lamy, 18 mi. south.

**BANDELLO, MATTEO** (c. 1480-1562), Italian novelist, was born at Castelnuovo, Piedmont, about 1480. Early in life he became a Dominican monk but abandoned this vocation. He accompanied Francis I to France in 1550, and was made Bishop of Agen by Henry II. His *Novelle*, a collection of stories, rank next to those of Boccaccio in Italy. Some are said to have furnished plots for Shakespeare and Massinger. Bandello died at Agen, France, in 1562.

**BANDE MATARAM**, meaning "Hail to thee, Mother," the rallying-song of the revolutionary party in India, written late in the 19th century by the Indian novelist, Bankim Chandra Chatterji. It is held to be an invocation of Kali, the goddess of death and destruction. The song's ingenious phrasing and stirring air have made it the recognized hymn of the Indian political extremists.

**BANDICOOT**, the common name for a genus (*Perameles*) of marsupial mammals. There are about



RABBIT BANDICOOT

12 species found in Australia, Tasmania and the adjacent islands. They are night-prowling animals that live on the ground. Some are clumsy, heavily built and measure about 16 in. in length. Others are small and delicate.

The most common species have piglike snouts and tapering tails. They live on worms, insects, bulbs, grubs, roots, fallen berries and other fruits, often doing great damage to gardens and corn fields. Their nests

are dry grass and leaves collected into a mound in a tangle of vegetation in which the bandicoot spends most of the day.

**BANDINELLI, BACCIO** (1488-1560), Italian sculptor and painter, was born at Florence, Oct. 7, 1488. He was the son of a celebrated Florentine goldsmith and was a bitter rival of MICHELANGELO. He was patronized by Cosmo de Medici, Charles V., Francis I and Clement VII. Bandinelli died at Florence, Feb. 7, 1560.

**BAND-PASS FILTER**, a combination of INDUCTION COILS and CONDENSERS so designed as to pass efficiently only such alternating electrical currents as have frequencies within predetermined limits.

**BAND SAWS**, saws with teeth formed on one edge of a band or ribbon of steel and with the ends joined by brazing or welding so as to make an endless band or loop. The band saw runs on pulleys of large diameter to avoid excessive bending stresses in the saw. Originally used on small, fine woodwork, the band saw is now used in many large saw mills for cutting the largest lumber, one great advantage being that the waste is much less than with the circular saw on account of the lesser thickness of the band saw. As a result of great improvements in steel manufacture and machine construction, band saws are now made for cutting metals.

F.H.C.

**BAND SPECTRUM**. Light passing through a PRISM or DIFFRACTION GRATING is spread into a series of component COLORS called a spectrum. If the source of light is an incandescent gas in a molecular state, as distinguished from an atomic state, the spectrum consists of a series of flutings or colored bands and is, therefore, called a band spectrum. For a discussion of the spectrum of a gas in an atomic state see LINE SPECTRUM. Bands may be found either in EMISSION SPECTRA or in ABSORPTION SPECTRA.

There are three distinct types of bands. One type, situated in the visible and ultra-violet portions of the spectrum, is called the electronic band spectrum. Another type, situated in the infra-red portion of the spectrum, possesses WAVE LENGTHS roughly ten times that of visible LIGHT and is usually termed the rotation-vibration spectrum. The third type possesses wave lengths which are still greater, from a hundred to a thousand times the wave length of visible light, and is termed the rotation spectrum.

The three names, rotation, rotation-vibration and electronic, originate in the kinds of molecular motion which are supposed to produce the respective types of band spectra. A MOLECULE may possess energy of rotation as a whole, energy of vibration of the ATOMS of which it is composed or energy due to the configuration of the ELECTRONS of which it is in part composed. Rotation spectra are associated with conditions producing very small energy transformations. Greater disturbances, resulting in vibrations of atoms within the molecule, necessarily produce changes of rotational energy at the same time and, hence, become manifest in rotation-vibration spectra. Spectra due to changes in vibrational energy alone, unaccompanied by rota-



tional effects, are unknown. Finally, forces sufficiently violent to disturb the electron configuration of the atoms composing the molecule necessarily produce changes of vibrational and rotational energy. The result is a rotation-vibration-electronic spectrum, commonly known as electronic spectrum.

The electronic spectrum is far more complicated than the other two, as would be expected, since it originates in a combination of all the possible types of motion within the molecule. In spite of its complication, the electronic type is much more easily studied than the others, because of its position in the visible and ultra-violet portions of the spectrum where visual and photographic methods can be used. Hence, it is much the best known of the three types.

When viewed under a low-power instrument electronic spectra appear as asymmetrical bands of color, each band being sharp at one edge, grading off gradually to darkness at the other. The sharp edge or band head, as it is called, is at the long-wave-length edge of some bands and at the short-wave-length edge of others. A narrow gap or dark region is usually visible in each band near the head.

When viewed under a high-power instrument, the bands no longer appear continuous, but are resolved into groups of closely adjacent lines. The increasing closeness of the spacing of these lines as the band head is approached seems, at first, to present a parallel to the series arrangement of lines in line spectra. The parallel is little more than superficial, however. Closer inspection shows that each band consists of two or three overlapping sequences of lines instead of one. It also becomes evident that the band head is not analogous to the convergence limit of a series in a line spectrum. The lines do not decrease in intensity as they approach the band head as do the lines of a line spectrum approaching the convergence point, nor does their spacing become infinitesimally small. It is, in fact, not the band head that is analogous to the convergence wave length of a line spectrum, but rather the dark gap near the band head, referred to above. This gap, that is, the wave length of the spectral line that is absent from the sequence, is taken as the wave length which characterizes a particular band in the way that a convergence wave length characterizes a particular series of a line spectrum.

Vibration-rotation bands and rotation bands are much simpler in their structure than electronic bands. In fact, rotation bands are not really bands at all, but consist simply of lines which, when arranged on a scale of frequencies instead of wave lengths, are equidistant. Vibration-rotation spectra are less simple. Like electronic bands, they possess absent, or null, lines, but, unlike electronic bands, their two branches are arranged nearly symmetrically on each side of these null lines.

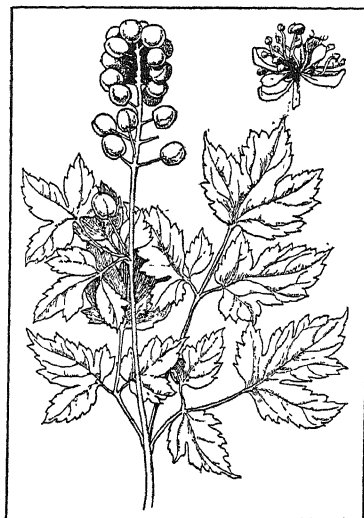
The QUANTUM THEORY has played a dominating rôle in the development of the theory of band spectra, as it has for line spectra. In fact, until the quantum theory was expounded there was no real theory of the origin of spectra of any kind.

The development of our knowledge of band spectra has been extremely rapid in recent years. The present indication is that within a decade or two band spectra will furnish information about molecular structure that is as circumstantial as that now furnished by line spectra about the structure of atoms. Much of the empiricism of present-day chemistry will thereby be removed, and the nature, direction and types of chemical transformations will be placed upon a mathematical basis.

L. W. T.

**BANDUNG**, also Bandoeng, a city of Java, capital of the Dutch residency of Mid-Preanger, in the western part of the island. Bandung is the third largest city of the Dutch East Indies and contains many beautiful modern buildings and parks. It is the seat of some of the principal scientific and educational institutions of Dutch India. Among industries the manufacturing of quinine is the most important. There is a munition factory and large railway repair shops. In 1926 the population was 170,000, of which 16,000 were Eurasians and the rest natives.

**BANE BERRY** (*Actaea*), the common name of several perennial plants of the crowfoot family with nauseous, poisonous berries. The red baneberry or black cohosh (*A. rubra*), with cherry-red berries, and the white baneberry (*A. alba*), with white berries,



FROM JEPSON, MAN. FL. PLANTS CALIF. COPYRIGHT

**WESTERN BANE BERRY**

(*Actaea spicata* var. *arguta*.) Flowering branch and single flower

grow wild in woods in many parts of the United States and Canada. The herb-Christopher of Europe and Asia (*A. spicata*), has purplish black berries.

**BANFF**, a town of Alberta, Canada, situated in the Rocky Mountains, at an altitude of 4,940 ft., near the junction of the Bow and Spray rivers. Banff is 85 mi. by road and 82 mi. by rail northwest of Calgary and about 41 mi. east of LAKE LOUISE. On the main line of the Canadian Pacific Railway and on the Trans-Canada highway, it is the headquarters

of Banff National Park. Excellent hotel accommodations, camp grounds, fishing, boating and other forms of summer and winter sports have made it a famous resort for tourist traffic. There are two government-controlled sulphur springs bathhouses, the Cave and Basin and the Upper Hot Springs, the latter being famous for its radioactive qualities. In the animal paddocks near the town are buffalo, elk, Rocky Mountain sheep, four-horned sheep, Rocky Mountain goats, Angora goats and yaks. A detachment of Royal Canadian Mounted Police is stationed in Banff to maintain law and order. Pop. 1921 (not including Indian reserves), 2,062; 1931, 2,519.

**BANFF PARK**, a Canadian national park formerly known as Rocky Mountain Park, situated on the eastern slope of the Canadian Rockies in the province of Alberta. It was established Nov. 25, 1885 and has an area of 2,585 sq. mi. Banff Park is an ideal mountain playground containing the two famous resorts Banff and LAKE LOUISE and much of the finest scenery of the Rockies. The mountains of this region are massive formations of stratified sedimentary rock, their summits and upper slopes bare and castellated or glacier-crowned. The lower slopes are covered with pine forests and flowered alplands. Wild life includes deer, bear, goats, sheep, elk and caribou, all protected by game laws. Hiking and pony trails radiate in all directions. Favorite recreations afforded by the park are alpine climbing, walking tours, riding, boating, swimming, golf, tennis, and motoring. Winter sports include ski-joring, tobogganing, skiing, snow-shoeing, and skating. Banff Park is about 80 mi. west of CALGARY by motor road. On the west the park adjoins JOHO with which it is connected by the Kicking Horse Highway over the Continental Divide and on the southwest it adjoins KOOTENAY with which it is connected by the Banff-Windermere Highway. It is also traversed by the main line of the Canadian Pacific railway.

**BANGALORE**, a city of India and capital of the State of Mysore. It is an important railway center about 200 mi. east of Madras, and is the largest British military station in southern India. In several respects Bangalore conveys the impression of a distinctly modern city. Its public utility plants have been constructed on modern principles, and even its palace is modern, which is unique in Indian capital cities. Its situation on the plain of the central region between the two Ghaut mountain ranges contributes to a healthy climate. Pop. 1921, 118,556.

**BANGKOK**, the capital of Siam, about 20 mi. from the mouth of the River Me Nam. The city handles 85% of the foreign trade of Siam. Its position on the Me Nam, with the river's innumerable side creeks, has made it a Venice of the East. From 1922-28 Bangkok was visited each year by about 1,000 vessels with an aggregate tonnage of over 1,000,000 tons annually. A bar at the mouth of the Me Nam, which permits the passage only of vessels of under 13 ft. draught, limits the activities of the port.

Many of the houses of the city are of wood, and

built on piles; others are erected on rafts moored on the river. In recent years many roads and streets lined with substantial houses have been built. The newer buildings include mills for rice, sugar and lumber, in a large part the property of Chinese. Est. pop. 1929, 600,000.

**BANGOR**, a city and port of Maine, county seat of Penobscot Co., 60 mi. northeast of Augusta on the Penobscot and Kenduskeag rivers; it is served by the Maine Central and the Bangor and Aroostock railways, steamers and motor busses. The Union, Penobscot and Machias rivers furnish power for diversified industries. Manufactures, including wood pulp, paper and textile products, were valued at approximately \$5,000,000 in 1929; the retail trade the same year amounted to \$23,067,042. Bangor is a commercial and agricultural center. Two state hospitals and the Congregational Theological Seminary are located here.

Bangor, originally called Sunbury, was settled in 1769 by Jacob Buswell; the name was changed in 1791 at the time of incorporation. The city was chartered in 1834. Samuel de Champlain, the French explorer, touched at Bangor in 1604 while searching for the legendary Norumbega. The first sawmill was built in Bangor in 1763 and the first vessel in 1791; from 1820-1870 lumbering and shipbuilding thrived and Maine pine became world famous. The British occupied Bangor in 1812. Charles Bulfinch planned many of Bangor's buildings and streets. Pop. 1920, 25,978; 1930, 28,749; 12% were foreign-born.

**BANGOR**, a borough in Northampton Co., Pa., situated 14 mi. north of Easton and 10 mi. southwest of Delaware Water Gap; served by two railroads. It is in a farming district, in the foothills of the Blue Mountains. There are blue slate quarries near by. The borough has structural slate works and factories producing gloves, hosiery, broadcloth, cables and hoisting machinery. Bangor was founded in 1860 and incorporated in 1874. Pop. 1920, 5,402; 1930, 5,824.

**BANGOR**, a cathedral town of Carnarvonshire, north Wales, situated 240 mi. northwest of London at the northern entrance of the Menai Straits. A Roman-British settlement, Bangor reached its educational and religious zenith in the time of Celtic Christianity. The cruciform cathedral of the town, built upon a 6th century site, suffered for centuries from hill raiders and was restored in the last century. The town's chief antiquity is the Friar's School, which dates from 1557. There are modern public works and several colleges. Slate quarried at Bethesda, six miles distant, is exported through Port Penrhyn. Pop. 1921, 11,029; 1931, 10,959.

**BANGS, JOHN KENDRICK** (1862-1922), American humorist, was born at Yonkers, N.Y., May 27, 1862. After graduating at Columbia University he studied law and became associate editor of *Life*, 1884-88, editor of *Literature*, 1898-99, *Harper's Weekly*, 1899-1902, *Metropolitan Magazine*, 1902-03, and *Puck*, 1904-05. Among Bangs's works are *The House Boat on the Styx*, 1895, and *The Cheery Way*, 1919

**BANGWEOLO, LAKE**, or **LAKE BEMLEA**, in east-central Africa in northern Rhodesia. Its outlines shift according to the amount of rainfall, but in general are situated between 11°-13° S. lat. and 29°-30° E. long. It is a shallow marshy lake, 3,700 ft. above sea level, with low shores skirted by rushes. In length it is about 60 mi. from north to south at its maximum and 40 mi. from east to west; during the dry period it occupies an area of approximately 1,670 sq. mi. Four large islands, inhabited by the Mboghwa, a tribe of shepherds and fishermen, lie in the north-western portion. The Chambezi is the principal eastern source of its waters; the Luapula, flowing from its southern extremity, is its outlet. DAVID LIVINGSTONE discovered the lake in 1868 and died on its southern bank in 1873.

**BANJERMASIN** or **BANDJARMASIN**, a city of Borneo, capital of the Dutch residency of south-eastern Borneo. The city is situated on both banks of the Matapara River, not far from its confluence with the Barito. Most houses either float on rafts or are erected on piles in the water. The city has an extensive trade in rattans, wax, rubber and spices. Coal, iron, benzoin and gold are obtained. Pop. 1928, about 70,000.

**BANJO**, a stringed musical instrument of African origin, the *bania* being a banjo in Senegambia. It consists of a circular parchment sounding-board attached to a long neck, up which the five or six strings are carried to the tuning pins. The finger-board consists of a series of frets inserted in the neck.

**BANKA**, an island of the Dutch East Indies, lying off the southeast coast of Sumatra, of which it is a residency and separated from it by Banka Strait. It is about 118 mi. long, 62 mi. wide and covers an area of 4,550 sq. mi. The surface is hilly, the highest point of land being Mt. Maras, 2,760 ft. above the sea. Like the neighboring island of BILLITON, Banka is famous for its tin deposits. Lead, iron, copper and arsenic are also mined. The chief agricultural products are rice, coffee, nutmegs and coconut palms. Pop. 1927, 169,281.

**BANK ACCOUNT.** See **BANK DEPOSIT**.

**BANKALAN**, a town of the DUTCH EAST INDIES, situated on the west coast of the island of Madura. It is one of the two important towns of that island and contains an old palace of the Sultan of Madura and a notable mosque. It is connected by tram line with Pamekasan, the capital of the island and with Sumenep, the other important town. Coconuts, coffee, copra and sago are the articles of trade. Pop. 24,000.

**BANK DEPOSIT**, the claim of an individual or an institution upon the assets of a bank; a right to

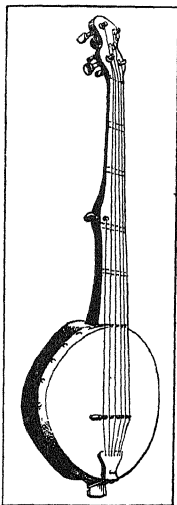
withdraw funds upon demand, as in a checking account, or after due notice, as in time and savings accounts. The item of deposits is usually the largest of the liabilities of a bank.

Bank deposits have undergone a marked evolution with the development of the credit system. They were originally sums of coin, money or bullion in the days before paper money was known, left with the banker for safekeeping in much the way that valuables are now left in a safe-deposit vault. Both the Italian bankers of the Renaissance period and the gold merchants of London at a later date accepted deposits of this sort. As the banking system developed, the banker gained legal title to such deposits, but obligated himself to repay the same amount to the depositor on demand. Since not all of the depositors were likely to demand the return of their deposits at any one time, the banker was able to invest a part of the total deposits, retaining a portion to meet the current withdrawals. How much had to be kept for this purpose depended upon the monetary habits of the depositors, and a banker who exercised good judgment in this matter was able to maintain the solvency of his bank at the same time that he made profits. This gave rise to the concept of bank reserves, upon which the whole structure of the modern credit system is based.

While the increased use of paper money, either in treasury notes or bank notes, and the spread of checking accounts brought to the banks a large volume of deposits in the form of claims upon other banks rather than as actual specie, the function of bank reserves against deposits was not materially changed. The proportion of reserves necessary to maintain solvency was however reduced, for many of the withdrawals of deposits, like the deposits themselves, were made in the form of book entries cleared without the reduction of cash holdings.

A large proportion of demand deposits arise from commercial loans made by banks to their customers, the proceeds being placed to their credit on the books of the bank to be withdrawn gradually as needed. It is for this reason that the aggregate volume of loans and deposits runs so closely parallel in a highly developed credit economy. Time deposits do not necessarily arise from loans, but are frequently savings accounts, or funds not required for immediate expenditure. The question of legal protection for such deposits has been frequently agitated inasmuch as the setting of a minimum reserve requirement under the law is not sufficient to protect time depositors in the case of failure of the bank. Several of the western states of the United States have passed laws establishing some form of cooperative insurance for bank deposits. See also **BANKS AND BANKING**. B. H. B.

**BANKER.** As business operations have become large and complex, so the work of the banker has become increasingly complicated. In general, banking can be considered under two major classifications, viz., investment banking and commercial banking.



COURTESY M. M. OF ART  
A BANJO FROM THE  
WEST INDIES

An investment banker supplies long-term credits to industry and commerce. He does this by underwriting bond, note and stock issues and reselling these securities to his customers—the investing public. For his services he receives a commission which varies from a fraction of 1% of the total amount of the issue to as much as 5% or even more when considerable risk is involved.

A commercial banker supplies short credits, usually of from three months to a year to industry and commerce. He does this by loaning the funds which his depositors have left with him, usually in the form of checking accounts and time deposits. The rates which are charged for these loans vary with the risk involved, financial conditions and the supply of credit available at the time the loan is made. Rates usually run from 4% to 6% per annum although rates for call money, i.e., funds loaned to members of the New York Stock Exchange against high grade, readily marketable securities, have at times been as low as 1% per annum. In addition to granting short-term credits, commercial banks usually have several other important departments, such as trust, savings or compound interest, and foreign.

On entering an investment or commercial banking firm or corporation, a school or college graduate usually begins as a clerk, junior salesman, or statistician. In addition to the monetary rewards, banking involves unusually interesting personal contacts and a real opportunity for service to the individual and the community.

W. P. J.

**BANKERS ACCEPTANCES**, drafts or **BILLS OF EXCHANGE** payable at a fixed or determinable date in the United States or abroad, in dollars or some other **MONEY**, based upon goods in production, transit or marketing. Upon the face of the acceptance has been acknowledged in writing the unconditional obligation of the **BANK**, banker, company or corporation engaged generally in the business of granting bankers acceptance credits, to pay at maturity.

The general principles of bankers acceptance credits are that **CREDIT** is extended, but no money is loaned, that in ordinary commercial use they are designed to supply assured bank credit to carry goods, in process of production, transit and marketing, that they are based on a specific transaction or a series of transactions of this kind rather than being used to provide borrowed working capital, that the completion of the underlying transaction for which the credit was established should liquidate the bankers acceptance, that the banker, ordinarily and as far as practicable, should retain control of the goods, receiving and applying the proceeds to the retirement of the credit when due; accordingly bills should be drawn to mature at about the time of the prospective liquidation of the transaction.

Member banks of the **FEDERAL RESERVE SYSTEM** were first permitted to accept drafts drawn on them, i.e., lend their credit, upon the passage of the **FEDERAL RESERVE ACT**. The Act also provided that Federal Reserve banks may rediscount bankers acceptances

when endorsed by a member bank or purchase them, if properly endorsed, in the open market, from banks, firms, corporations or individuals provided they comply with all requirements for eligibility.

These requirements provide that the bankers acceptance must have been drawn under a credit involving the shipment of goods between the United States and any foreign country or between the United States and any of its dependencies or insular possessions, or between foreign countries; the shipment of goods within the United States; the storage in the United States or in any foreign country of readily marketable staples provided the bill is secured at the time of acceptance by a warehouse receipt of a warehouse company independent of the borrower; and for the purpose of creating dollar exchange in certain specified countries. A bankers acceptance, from the point of view of security ranks first among all forms of commercial credit instruments, being the direct, primary obligation of the accepting bank or banker. It thus invariably commands a lower rate than is charged for **COMMERCIAL PAPER**, time money or bank loans.

R. H. B.

**BANKET**, originally a Dutch term applied to the gold-bearing **CONGLOMERATES** of the Rand in South Africa. It is now also used for other compact conglomerates, in which pebbles about the size of eggs are cemented by vein quartz, resembling the original Witwatersrand conglomerates.

**BANK FOR INTERNATIONAL SETTLEMENTS** constitutes the framework around which the **YOUNG PLAN** was built. Since the latter abolished all the various political controls imposed on Germany, it was necessary to establish another agency to replace it and to perform those functions previously performed by the Agent General for **REPARATIONS**. The experts who formed the Young Plan reached the unanimous conclusion that there was needed a common center of action and authority for the purpose of coordinating the control of the various arrangements established by it.

The chief purpose of the Bank for International Settlements centers around the collection and distribution of the reparations annuities, as follows: 1. The Bank acts as trustee of the creditor governments in dealing with the German annuities. In this capacity, the bank has received from Germany the certificates of indebtedness representative of the annuities and has issued to the creditors the trust receipts for such certificates. 2. It receives and disburses to the paying agents the service on the German external loan of 1924 (see **DAWES PLAN**). 3. It receives and distributes the German annuities. 4. It performs, as regards deliveries in kind, such functions as may be entrusted to it by the various governments. In addition, the bank facilitates the mobilization of the annuities and acts as trustee for the Young Loan floated in 1930.

The purpose of the Bank for International Settlements, however, is much broader than merely to create a machinery for the payment of reparations. It

endeavors to provide additional facilities for the international movement of funds and to afford a ready instrument for promoting international financial relations. In addition it is hoped that eventually the bank may help develop countries lacking in capital.

The statutes of the bank define clearly the various operations in which the bank may engage. It may act as a deposit and discount institution for central banks. It may deal with private banks and individuals if the central bank of the respective country does not object. It also acts as clearing house for the various central banks and at critical times has devoted considerable attention to checking the unnecessary movement of gold. The bank may buy and sell gold and foreign exchange, may rediscount for central banks, may buy or sell for its own account short- and long-term bonds (*see BONDS*) not to exceed the amount of paid-in capital and surplus. In order to attract long-term deposits, provision is made for the sharing of profits of the bank by those governments or central banks of the creditor nations of Germany which maintain time deposits of a maturity of not less than five years. Inducements are also offered to Germany to maintain long-term deposits with the bank. The bank is not allowed to issue notes. It must maintain a reserve of 40% in gold or foreign exchange against its demand deposits. All other deposits require a reserve of gold or foreign exchange of 25%.

The Bank for International Settlements was established by mutual consent in Basel, Switzerland. It has an authorized capital of \$100,000,000 of which only 25% has been paid in. The directors are empowered to call for further installments as well as to increase or decrease the capital of the Bank. Fifty-five per cent of the capital was sold in the United States, Great Britain, France, Italy, Belgium, Germany, and Japan. The other 45% was sold in various countries interested in reparations or in countries not interested in reparations whose currencies have been stabilized on a gold or gold exchange basis.

The shares carry no voting right. The voting right is exercised by the central bank of the country where the shares have been obtained. According to the statutes, the Board of Directors may consist of not less than 14 and not more than 25 members. The directors of the bank consist of the governors of the seven central banks of the countries mentioned above or their nominees, each of whom will appoint another director of his own nationality. During the period of the German annuities, the Governor of the BANK OF FRANCE and the President of the REICHSBANK may each appoint one additional director of his own nationality. If a central bank of any country or its governor is unable to act officially or refrains from acting as director of the Bank for International Settlements, the statutes provide "that alternative arrangements not inconsistent with the laws of that country shall be made." Thus, the representatives of the United States on the Board of Directors of the Bank for International Settlements have no official relationship to the federal reserve banks.

The distribution of the profits also indicates the peculiar character of the bank. After making provisions for the establishment of a reserve fund and payment of dividends, the balance of the profits is distributed as follows: "Of the available balance, 75% to the governments or central banks of the creditor countries or Germany which maintain five-year time deposits with the bank, divided proportionately to the size of the deposits maintained by the respective governments or central banks; 25% to be used to aid Germany in paying the last 22 annuities provided the German Government maintains a long-term deposit with the bank of at least 400,000,000 reichsmarks (about \$100,000,000). If the German Government elects to make a long-term deposit of a sum below 400,000,000 reichsmarks the participation of the German Government shall be reduced in proportion and the balance added to the 75% mentioned above."

At the beginning of 1931 the bank was instrumental in forming an international mortgage bank whose main purpose is to facilitate the conversion of short-term funds into long-term capital and of moving capital from markets where it is not needed to markets where it is required for desirable economic ends.

M. N.

**BANK HISTORY.** Traces of banking functions may be found far back in history. The temples of early Greece served as safe deposit vaults for their devotees; there were private bankers in Athens and Alexandria who made loans; and banking offices beside the Forum in Rome were familiar with deposits, loans and mortgages. But during the Dark Ages in Europe most of this technique was lost, and the history of banking begins again in the Italian cities of the 10th century, with their wide commercial connections, their wealth, and their enterprise. In spite of clerical opposition to usury, monasteries with ample incomes often made loans. Jews and Lombards gradually developed the business of money lending and money changing. The latter was essential down to the 17th century because each petty state issued its own coinage and frequently debased it. Each king and prince was associated with his own group of bankers and financiers, and his fortunes determined theirs, since if he failed to pay his debts, they were ruined.

By the 17th century, private banking was developing, the dealings of well known merchants in bills of exchange expanding into independent discount and foreign banking houses which financed foreign trade in much the same way as at present. During the same period the transfer bank was developing, which permitted the making of payments by transfer on the books of the bank in which a deposit—actual specie or ingots—had been made. These existed in Barcelona, Genoa, Venice, Milan, Amsterdam and Hamburg, and laid the foundation for the modern bank of deposit and clearance.

Although tentative efforts at note issue had been made several times previously, it was not until the Bank of England was established in 1694 that genuine

progress was made along those lines. The success of the Bank of England in providing the government with funds at almost no cost, gave an impetus to the establishment of other such banks, and produced a new form of INFLATION in the world. Abuse of the note issue function brought a serious crisis in England in 1797, when SPECIE PAYMENTS had to be suspended until 1821; other crises occurred in 1824 and 1837. In 1844 the enactment of the Peel Act separated the note issue department from the banking department.

After the establishment of the Bank of England, there were organized a number of private banks in England, which also issued notes and made loans. The law of 1826 authorized the existence of joint-stock banks outside of London, and after 1833 in London. Their growth was rapid, and they began gradually to supersede the private banks, absorbing many of them as branches. The process of AMALGAMATION, which still continues, has reduced the number of joint-stock banks as well as of private banks, and in 1930 there were only 16. Five-sixths of the English banking business is in the hands of the Big Five. One important feature of the English banking system is the use of the OVERDRAFT, by which the customer is granted a loan in the form of permission to overdraw his account. Such action is contrary to the National Bank Act of the United States. Scottish banking is similar to that of England in many respects, but notes are issued by the banks against their general assets, as in Canada, without specific reserves or security.

Due largely to the political uncertainties of their existence, the countries of Europe lagged behind England in the development of commercial banking, and much of the business has been in the hands of wealthy private bankers. In France, after the country's unfortunate experience with Law's Bank (1717-1720), the *Caisse d'Escompte* (1776-1793) and the assignats, whose history resembled that of the American Continental notes, banking was entirely in the hands of private banks until the organization of the Bank of France in 1800, under Napoleon. Commercial banking did not get under way until the second half of the 19th century, and even then had to be stimulated by the government. Deposit banking, with the attendant use of CHECKS, is still not as widespread in France as in the United States or England. Many of the commercial banks combine an important investment banking business with their more strictly commercial business. The banking system of Belgium is very similar to that of France, and there are many ties between banks of the two countries.

Banking in Germany began a rapid development about the middle of the 19th century, with the establishment of several joint-stock banks. German banks are more closely in touch with industry and foreign trade than those of any other country, and the banks grant long-term industrial loans as well as the short loans which are usually considered the particular province of the commercial bank. The tendency in Germany, as in England, has been steadily towards

centralization, with head offices of banks in Berlin and many branch banks through the country. The four large D banks—the Dresdener, the Discontogesellschaft, the Darmstädter, and the Deutsche—with two others, the Berliner Handelsgesellschaft, the Kommerz und Privatbank of Hamburg, control the greater part of the German banking business. The German overseas banks have played an important part in building up German foreign trade.

See also REICHSBANK; FEDERAL RESERVE SYSTEM.

B. H. B.

**BANK NOTES**, the issue of paper notes by BANKS to be used as substitute for coin, probably dating back to the earliest Italian banks in the 16th century, and in England to the early receipts issued by goldsmiths against gold deposited with them for safe-keeping.

During the period when banking was considered to be a common law right of any citizen, the issue of bank notes was open to anyone who organized a bank. Since the profits of the bank depended upon the volume of notes kept in circulation, these banks were not anxious to redeem their notes, and the public often lost heavily. Gradually the issue of notes has been brought under control. In the United States the National Bank Act resulted in a uniform national note, and in 1865 the state bank notes were taxed so heavily that their issue was abandoned, greatly improving the quality of the circulation. The national bank notes, based on government BONDS, could not be easily increased and decreased (See NATIONAL BANK ACT).

In many countries the issue of bank notes has been made a function of the CENTRAL BANK, and nearly all nations now place legislative restrictions about such issues. Bank notes are now much less important than deposit credits, since the use of CHECKS has become widespread among nearly all classes. On the other hand, bank notes are now generally used instead of coin for payments which must be made in cash, such as wages and small retail purchases. The World War brought about the removal of gold from general circulation and the substitution of paper notes issued either by the banks or by the Treasury Department. Post-war stabilization has stopped the issue of Treasury notes and bank notes are now the only important form of paper money in circulation.

Since bank notes are in effect PROMISSORY NOTES of the bank payable to bearer on demand, most issuing banks are required by law to maintain a reserve of specie, as well as a reserve against deposits. See also SPECIE PAYMENTS.

B. H. B.

**BANK OF ENGLAND**, the oldest central bank, was established in 1694 on a plan devised by William Patterson, to provide the government with funds by issuing bank notes against government securities. The early history of the bank was uneventful except for its failure to redeem notes in specie from 1797 to 1821. Present operations of the bank are still based largely upon the provisions of the Peel Act of 1844, which separated the issue department entirely from the bank-



ing department in order to prevent another suspension of SPECIE PAYMENTS. All notes, except those based upon £14,000,000 of government securities, were required to be backed fully by gold.

During the 19th century the Bank of England gradually developed a technique for carrying out its responsibilities as a central bank. The panics of 1847, 1857, and 1866 proved that the best way to meet such a situation was by continued lending at higher rates. The discount policy thus devised has proved a valuable means of controlling the money market at all times. When there is a strong demand for credit, bill brokers are obliged to rediscount their bills at the bank, and the reverse process takes funds out of the market when conditions are easy. The BANK RATE is usually above the market rate, which enables the bank to control the amount of funds in the market. If rate changes alone are not effective, the bank can go into the open market and buy or sell government securities.

Since it carries balances for other banks, which depend upon it to provide them with gold when they require actual specie, its reserves are the central gold reserve of the nation, and changes in it are closely watched, not only by England, but by all the world. Before the World War, London was practically the only free gold market, and a large part of the foreign trade of all nations was financed by sterling bills. During the War, England, like most other European nations, was obliged to abandon gold payments, and permitted the issue of notes (*see* BANK NOTES) against government securities without gold collateral. The bank has always been closely related to the treasury, and it gave indispensable aid in financing the war. In 1925 England again returned to the gold standard, and in 1928 consolidated the war-time currency notes with the regular Bank of England notes, requiring any issue beyond £260,000,000 to be backed fully by gold. The gold standard was again abandoned in 1931. B. H. B.

**BANK OF FRANCE**, organized in 1800 as a part of Napoleon's plan for meeting the needs of commerce, started with the right simply to discount 60-day bills, accept deposits and issue notes, but its functions gradually expanded and it assumed its dominant position in 1848 when it obtained the exclusive note-issue privilege. The Bank is a private corporation of 1,825 million francs capital. Its shares are sold on the Paris Bourse, but its governor and two deputy-governors are appointed by the President of the Republic.

The Bank of France accepts deposits from other banks and from individuals, and rediscounts commercial paper bearing three names. Against its liabilities it must keep a reserve of 35% in gold. The gold of the Bank of France is the central reserve of the country, and the Bank usually has much more than the legal minimum. Unlike other central banks which rely upon changes in their discount rate to protect the gold reserve and to regulate the money market, the Bank of France has kept its rate low and

steady, and conserves gold by charging a premium. Since the stabilization of the franc on a gold standard in 1928, a gold premium is no longer permitted. The Bank is therefore trying to develop an open market policy to supplement its discount rate. *See also* CENTRAL BANKS; BANK OF ENGLAND; REICHSBANK; REDISCOUNTING. B. H. B.

**BANK OF THE UNITED STATES.** The first Bank of the United States was nationally chartered in 1791, as a part of Alexander Hamilton's financial plan. Its head office was in Philadelphia, then the capital of the United States, and branches were opened in New York, Boston, Baltimore, and Charleston; later also in Norfolk, Savannah, Washington and New Orleans. The capital of the bank was \$10,000,000, of which the government took one-fifth. Officers and directors were chosen by the stockholders. Loans to the government were limited to \$100,000; to each state, \$50,000. Discounts not to exceed 6% were made twice weekly. The bank was required to redeem its notes in specie. They were issued in denominations of \$5 and up. The total circulation never exceeded \$6,000,000. Due to political opposition and the jealousy of state-chartered banks, the charter of the first Bank of the United States was not renewed, and the bank went out of business in 1811.

Suspension of specie payments by state banks, and Treasury difficulties arising from the War of 1812, resulted in the Second Bank of the United States in 1816. Its capital was set at \$35,000,000, one-fifth of which was held by the government, and five of its twenty-five directors were government appointees. The head office was at Philadelphia, no longer the capital of the country, but still the chief commercial city, and 27 branches were established in important centers. The bank reached the climax of its power under the presidency of Nicholas Biddle. He developed the sale of sterling exchange bills for use in foreign trade, popularized the use of drafts drawn on branch banks (*see* BRANCH BANKING) for domestic trade, made transfers of funds for the TREASURY and assisted it in all its operations, and kept the note issues of the state banks within bounds by sending notes home promptly for redemption, thus arousing much opposition, which was increased by the anti-monopoly feeling of the Jackson Democrats (*see* JACKSONIAN DEMOCRACY). President Andrew Jackson, after a bitter political fight, vetoed the renewal of the bank's charter in 1832, withdrew the government deposits in 1834, and by the time its charter expired in 1836 the bank had been divested of its power and its prestige. It continued for a few years longer under a Pennsylvania charter, but was completely undermined during the crisis of 1837, and finally failed in 1841. B. H. B.

**BANK RATE**, the official rate of interest at the CENTRAL BANK of a country. It is the rate at which the customers of the central bank, or other banks—in some countries others as well—can secure credit by rediscounting the best negotiable paper. In London it applies to bankers' acceptances bearing two English

names. In France it covers three-name paper, or paper with two names collateralized by other security; in Germany it applies to bankers' acceptances of three months maturity or less, bearing three endorsements, or two endorsements with other security. In the United States, the bank rate applies to short-term COMMERCIAL PAPER and ACCEPTANCES. At each of the central banks there is a scale of rates applying to other types of paper, or to borrowers who are not regular customers.

Changing the bank rate is the most usual method employed by central banks for protecting reserves of gold, and regulating the money market. When foreign exchange rates have moved to a point where there is danger of gold export, the central bank may by raising its rate, encourage foreign balances to flow into the country and thus counteract the outward drain. The higher rate also initiates a contraction of credit, which will eventually lower the volume of IMPORTS, stimulate EXPORTS and further reduce the foreign drain of gold (*see also* GOLD POINT). This use of the bank rate was developed at the Bank of England during the middle of the 19th century. Before the World War the Bank of France preferred to keep its rate of discount low, with few changes, protecting its gold reserve when necessary by exercising its option of redeeming notes in silver. Since France has changed the limping gold standard to the full gold standard, this course is no longer open.

Another method of supplementing the bank rate in the control of the money market is the open-market policy of the central bank. In open-market operations the central bank abandons its passive role, and instead of discounting only the paper brought to it, goes into the market on its own initiative, buying or selling as the case may require. Government securities as well as commercial bills may be utilized for this purpose. The Bank of England and the Reserve banks of the United States (*see* FEDERAL RESERVE SYSTEM) have been most active in developing open-market technique, but other central banks are also beginning to apply it.

The use of the bank rate is not entirely effective in controlling the money market unless other economic conditions are propitious. If the balance of international payments is causing a large amount of gold to flow into the country, the raising of the bank rate will probably be powerless to stop an inflation of credit based upon the incoming specie. On the other hand, after a severe crisis in the money market, a mere reduction in the bank rate will be insufficient to start a revival of business, unless the depression has run its course and fundamental conditions justify a return of confidence.

B. H. B.

**BANK RESERVES**, assets in the form of actual cash in its own vaults, as deposits with some other bank, or as liquid assets readily convertible into cash at need, kept to maintain a bank's solvency, and to meet the demands of its depositors or the holders of its notes in cash. As commercial banking has developed, the law, especially in the United States, has

taken over more detailed regulation of reserves. When a bank's circulation was the most important of its liabilities, the law regulated the reserve to be held against circulation, but as deposits grew in relative importance, they too came under the law. The National Bank Act continued this legal regulation, recognizing balances with other banks as well as cash to be suitable for reserves. In the Federal Reserve Act, as amended in 1917, balances at the Federal Reserve bank are alone required of member banks as reserves.

The increasing use of deposit credits as a means of payment makes it possible for the banking system to function with a declining proportion of actual specie. Although the actual volume of gold and gold coin has increased, the ratio of coin to deposits and note circulation has been declining steadily in the United States for more than a century. Another factor in the declining reserve ratio is the increasing concentration of bank reserves. The country banks of the United States have long been accustomed to keep part of their reserves as balances in New York. These balances formed part of the deposits of the New York banks, and against them they held a specie reserve, but this amount of specie was not as large as if the country bank had kept the same amount in the form of cash. The Federal Reserve Act lowered the amount of cash required of member banks as reserve, and in 1917 eliminated altogether the cash requirement, providing only that member banks keep a specified balance at the Reserve bank against deposits. National bank notes continued to be secured by government bonds deposited with the COMPTROLLER OF THE CURRENCY.

Commercial banks in other countries are in general subject to less regulation in the matter of reserves than those of the United States, the matter being left to the judgment of the banker, but this does not result in lower reserves.

Central banks in every country are closely regulated by law as to reserves. Many of them have been granted a monopoly of the right of note issue, a privilege which carries with it the responsibility for redeeming the notes at all times. The Bank of England notes, except that part which is protected by government securities, is covered in full by gold coin or bullion. The Bank of France must maintain a gold reserve of 35% of notes and current liabilities. The Reichsbank must hold 40% reserve against notes, of which one-fourth may be in foreign bills of exchange, but at least three-fourths in gold.

B. H. B.

**BANKRUPTCY**, the adjudication of a debtor's inability to pay his debts. Bankruptcy proceedings are of two kinds: voluntary and involuntary, i.e., instituted by the insolvent debtor or by his creditors. Two of the main purposes of these proceedings are to secure an equitable division among creditors of the bankrupt's available assets and to release or discharge the bankrupt from his obligations if he has complied with the provisions of the law.

In England, the first statute on bankruptcy (Statute

34 and 35, Hen. VIII, c. 4), which was enacted in 1542 and repealed in 1825 (Statute 6, Geo. IV, c. 16), was aimed at fraudulent debtors. Later statutes turned more to the relief of debtors but until 1861 bankruptcy was a privilege restricted to traders. Voluntary petitions in bankruptcy were allowed in 1825 (Statute 6, Geo. IV, c. 16) but were withdrawn by the Bankruptcy Act of 1869. The Bankruptcy Act of 1883, besides re-allowing the filing of voluntary petitions, for the first time discriminated between insolvency through misfortune and that due to misconduct. The present Bankruptcy Act was passed in 1914. In the United States the law of bankruptcy has had a curious history. Although the Constitution vests in Congress the power to establish "uniform laws on the subject of bankruptcies throughout the United States" (Art. I, Section 8, cl. 4), there was no permanent law on bankruptcy until 1898. Previous to that date, in 1800, 1841 and 1867, three statutes were enacted during periods of business depression and repealed in 1803, 1843 and 1878, with the return of prosperous conditions. All except the first statute, which was confined to traders, granted bankruptcy privileges to all classes and provided for voluntary bankruptcy.

Any person who owes debts, except a municipal, railroad, insurance or banking corporation, may become a voluntary bankrupt (Bankruptcy Act [1898] 4-a). On the petition of three creditors with claims amounting to \$500 or more, or of one creditor with a \$500 claim if the creditors are less than twelve and any person who owes debts aggregating at least \$1,000 excepting a wage-earner receiving \$1500 a year or less, a person engaged chiefly in farming or tilling the soil, an unincorporated company, and a municipal, railroad, insurance or banking corporation, may be adjudged an involuntary bankrupt on the showing that he has committed an act of bankruptcy within four months prior to the filing of the petition. Acts of bankruptcy are conveyance of property with intent to hinder or defraud creditors; transference, while solvent, of any property to one or more creditors with intent to prefer; suffering a creditor to obtain a preference by legal proceedings and not vacating or discharging such preference at least five days before sale of the property involved; making a general assignment for the benefit of creditors or, being insolvent, applying for a receiver or trustee of property; and admitting in writing inability to pay debts and willingness to be adjudged bankrupt on that ground.

Federal courts have exclusive jurisdiction in bankruptcy proceedings. Upon the filing of the petition, a receiver is usually appointed to conserve the debtor's assets. The debtor may appear in court and demand jury trial as to his insolvency and commission of acts of bankruptcy. If the allegations in the petition are found true, adjudication of bankruptcy follows. Otherwise the proceedings are ended. After adjudication, creditors have six months to file proof of claim. Title to the bankrupt's property except that exempted by law vests in a trustee or trustees elected

by the creditors. Under the court's direction, the bankrupt's assets are converted into cash by the trustee, and, after payment of expenses of administration, certain taxes, wages not above \$600 and other claims given priority, dividends are distributed on the proved and allowed claims of general creditors.

Within a specified period after the adjudication, the bankrupt may petition for a discharge, to which he is entitled as a matter of right unless interested parties oppose it. Grounds for opposition are commission of offenses punishable by imprisonment under the Act; destruction of or failure to keep records with intent to conceal financial condition; obtaining credit on a materially false written statement made for such purpose; making or permitting to be made fraudulent transfer, removal, destruction or concealment of property; in voluntary proceedings, having had previous discharge within six years; and refusing to obey court orders or to answer material questions. The discharge releases the bankrupt from legal obligation to pay all provable debts except debts due as taxes, alimony, wages due to workmen, clerks, salesmen and servants earned within three months before commencement of the proceedings, debts not scheduled for proof, unless the creditor had notice of the proceedings and all liabilities arising out of willful misconduct.

C. F. We.

**BANKS, SIR JOSEPH** (1744-1820), English naturalist. He attended Eton and Oxford, and a few years later visited Labrador and Newfoundland, returning to England with many specimens of plants. His next important scientific voyage was with Captain Cook to the Pacific Ocean, following which he was active in expeditions to Iceland, always bringing back many specimens for his studies in natural history. Banks was born in London, Feb. 13, 1744 and died at Isleworth, June 19, 1820.

**BANKS AND BANKING.** By bank, is meant an institution of credit whose transactions are predominantly short, i.e., intended to facilitate the exchange of consumption goods. Banks often broaden their operations beyond this field, and devote themselves to dealings in securities, and to the facilitation of exchanges based thereon, or they finance the development of lands and mines. For them to figure successfully for any long time as banks, however, the bulk of their transactions must be arranged upon a short-term footing. Banking is the process of carrying on the bank, but the term has been broadened in later significance to apply chiefly to the larger aspects of policy, while bank administration is used to describe the routine management of the bank.

**Banking Functions.** The older classical writers described the bank as an institution which performed the functions of discount, deposit, and issue. Discount was the process of lending in the form of book credit. Deposit was the process of placing funds with the bank to be held by it (and since a discount resulted in the creation of a loan or credit, it was ultimately thought of as the chief source of deposits). Issue was the preparation of the bank's own direct

obligations, to be used as circulating medium instead of MONEY; and the lending them to customers who had discounted paper. Incidentally, the bank of course received actual money—gold, silver, or government notes on deposit account; but this kind of deposit soon was recognized as incidental and secondary, the bulk of depositing being the result of loans. The three-fold separation of function thus described was the outgrowth of observations and conditions prior to the modern credit period, which may be viewed as beginning about 1850. As the second half of the 19th century advanced, the bank came to be viewed more truly as an institution which judged the worth and character of credit obligations offered to it; and, when it thought fit, substituted its own obligations for those of its customers, thus in fact guaranteeing the latter. Such substitution took place when the bank received and discounted the customer's note and gave him a deposit credit for an equal amount; it took place also when the bank gave its customer, in exchange for his note, its own notes to an equal amount. It took place likewise when a customer, with a deposit to his credit, asked for ready cash and received in answer the bank's own notes. So the distinction of the classical economists (*see* CLASSICAL SCHOOL OF ECONOMICS) has been in effect abandoned, and today the bank is with few exceptions viewed as a credit institution whose main function is the judging of credit and the guaranteeing of it in the way just indicated, through the substitution of its own.

**Theory of Banking.** During the years in which the view just stated has been evolved, a distinct theory of banking has grown up. The function of the bank being essentially the judgment of CREDIT, the only limit to its activity is found in the total basis for bank credit that is produced in the course of economic life. Having recognized the basis for credit as existent in a given sort of paper, the question how far the bank is warranted in guaranteeing it, or of making loans in popular parlance, recurs. What the customer or borrower wants is purchasing power which will be available in any market; and, in order to provide him with such a medium, the bank must sedulously protect its own standing by proving its own ability to make good its guarantee—i.e., by converting its obligations into money on demand. The extent to which it can grant credit thus depends on the extent to which it can redeem its own outstanding obligations; and this is in general dependent upon two elements: the extent to which the community is willing to receive and hold its obligations without immediate redemption; and the extent to which the bank itself succeeds in making its maturing claims on customers offset the presented claims of customers upon it. Experience indicates the necessity of maintaining what is called a reserve for this redemption purpose and indicates as well that the amount of such reserve needed varies from place to place, and from nation to nation. Additions to the reserve (in practice, to the specie stock of the nation)

theoretically permit a larger grant of credit and withdrawals curtail it, provided a steady pressure of demand for loans based upon sound paper be assumed. Hence the acceptance of a duty to protect and conserve the specie stock of the nation, and to save it from undue depletion. Hence also the development of a special type of banking known as central banking, whose mission it is to safeguard the national stock of specie, reduce the necessity for specie in ordinary bank settlements, and finally to control or oversee the efforts of the several banks to expand or contract.

**Systems of Banking.** While practically all banking systems, in one way or another, seek to establish institutions designed to carry on the operations already described, differences of method and technique exist, sufficient to permit of the recognition of differing "systems" of operation or management. These differences relate chiefly to three matters: the conditions under which banks may be established; the relation of such banks one to another; and the relation of these banks to the public and its business. Under the first head, there may be recognized: the "free banking" system, in which charters to establish banks are granted on equal terms to all, under a general law, as illustrated in the national banking system of the United States; the independent-charter banking systems in which a special act of legislature is required to permit the formation of a new institution, e.g., the banking system of Canada; and the plan in which banking is a state monopoly to be carried on as such; the best example being found in Russia, though other countries approach the same situation more or less distantly. Under the second head, three main types of interbank relationship may be observed: that in which banks merely deal with one another as they will and without special regulation (as again in Canada); that in which they are linked in a "correspondent" system of some sort, as under the old national banking system of the United States and that in which they find it necessary, as the result of law or custom, to maintain a given relationship with a central bank possessing the functions already briefly indicated. Under the third head may be enumerated as types of relation to the public: the so-called unit type of bank, in which all transactions are carried through at one single office; the branch system in which any bank may have a number of offices; and the group or chain system in which various banks are owned and operated by a holding company or corporation. The major differences of these various systems are found, first of all, in their ability to serve public convenience, secondly in their relative capacity to maintain solvency and liquidity, and third in their power to finance large transactions with success and safety. There is no one system which can be definitely said to be superior to all others in all circumstances. Banking needs differ with the needs and organization of business.

**Banking Law and Oversight.** Most countries have developed a distinct system of law and state

oversight with respect to banks and banking. This body of law and custom usually deals (among others) with the following topics: the making of commercial, bankable paper and its validation; the observance of safety rules and regulations designed to protect the solvency and liquidity of the bank; the auditing and inspection of the bank's affairs in order to ensure observance of law and honesty on the part of managers; the conservation and redistribution of the bank's assets in case of failure; the conditions under which banks are opened, closed, merged with others, and recapitalized. There is great difference of practice with regard to all these matters. Most countries have now a well-developed law of commercial paper, and special legislation governing the position of the bank with regard to it. Probably the majority have laws providing for establishment and withdrawal of banks. A minority provide for regular auditing and inspection at the hands of public authorities, but there are several—Great Britain being the most notable, in which banks are left subject for the most part to the general corporation law so far as organization and management are concerned. In the United States, every one of the commonwealths (in addition to the Federal government itself) has a banking law and important differences exist between these state codes.

**Bank Management.** Bank management and organization have tended more and more to assume a stereotyped form. A board of directors, charged with very definite powers, and subject to well defined liabilities, is first organized. It usually divides its more important powers among committees, whose operations are governed by carefully drawn by-laws. The Board elects executive officers—chief among them, ordinarily, its own chairman and a president. The latter may or may not be made a member of the Board, but practice is increasingly in favor of such membership. The president may be aided by one or more vice-presidents according to the size of the institution. A cashier who is chief of staff and looks to the inner discipline of the bank is also ordinarily named. Other officers vary according to the departments into which the bank's work is divided, but the latter usually include a division for the receiving of deposits, one for the paying of checks and claims, one for the study and judgment of credit, one for the clearing and collecting of items, one for the management of foreign business (foreign exchange), one for the management of relations with other (local) banks through the CLEARING HOUSE whose duty it is to settle inter-bank items with as little use of cash as may be, and of course one for the conduct of the bank's books and accounts. The findings of the credit department are usually conveyed to the executive committee (or loan and discount committee); and this body establishes "lines" of credit for the different applicants, while the actual assignments of credits within such lines are made by "loaning officers," usually vice-presidents.

**Relation To Money Market.** In every country where banking has been highly developed there is a

strong tendency to specialization and consequently a tendency to divide the market for accommodation into different sections more or less independent one of another. Trading soon begins among these various lending agencies in order to equalize supplies, and accommodation between banks and other institutions assumes the aspect of a definite business. Where the government of the country is a regular borrower on paper of a standardized bankable form (Treasury bills or short term certificates), these also figure largely in such trading. The result is to bring about a series of rates of interest, corresponding to the varying terms upon which credit is granted (or money lent). Among these varying rates, the bank rate represents the charge for standard short-term accommodation. When there is a central bank, the discount rate of the latter represents this same charge, freed practically of elements of risk or doubt. It is the community's estimate of the rate most suitable for determination of the distribution of its available credit power. Variations in this rate consequently act in some degree as a means of controlling its use by rendering credit accommodation more or less expensive. The banking system thus acts, indirectly as well as directly, in the capacity of governor or controller of the supply of credit. *See also* BRANCH BANKING; CENTRAL BANK; CHAIN BANKING; COOPERATIVE BANKING; INVESTMENT BANKER; SAVINGS BANKS, UNITED STATES. H. P. W.

**BANKS OF ISSUE**, those possessing the right to issue PAPER MONEY. This right was formerly held to be inherent in the right to operate a bank, just as the right to operate a bank was formerly held to be open to any one. In the early days of BANKING, most bank credit was issued in the form of note circulation (*see* BANK NOTES), the proceeds of bank loans being taken out by the borrowers in this fashion. Since banks made their profits by making loans, they were anxious to keep these loaned notes in circulation as long as possible, and frequently made little or no provision for their redemption. Such was the situation in the banking history of the United States under the state banking system (*see* NATIONAL BANK ACT). This period was marked by frequent INFLATION, by excessive issues of notes, and by the poor credit of many of the notes, as evidenced by the large discount at which they were received.

The right of issue gradually became regulated by law, as under the provisions of the National Bank Act, or taken away from commercial banks altogether and concentrated in the hands of the CENTRAL BANK, as in England, France and Germany. The FEDERAL RESERVE ACT of the United States was a step in the same direction, since, although it did not abrogate the privileges of the national banks to issue their bond-secured notes, it limited the privilege of issuing the newer forms of notes solely to the Reserve banks. In England this change was made by the Peel Act of 1844, which gave the BANK OF ENGLAND the monopoly of note issue for the future, made its notes LEGAL TENDER except at its own counter and em-

powered it gradually to take over the note issues of other banks. In Germany a similar provision was incorporated into the law of 1875 which created the REICHSBANK. Of the 32 regional banks which had formerly possessed the right of issue, only four now remain, and their notes are no longer legal tender. In France the BANK OF FRANCE is the sole possessor of the right to issue notes, and has been so since about 1850. The banks of Canada have a unique privilege in that they may issue notes up to the amount of their paid-in capital, without any special security except a 5% guarantee fund.

Most of the central banks established in Europe since the end of the World War have been given a monopoly of the note issue power. The modern trend is to place the issue of bank notes in the hands of a government-controlled central bank. *See also* FIAT MONEY; FIDUCIARY ISSUE; RESERVES.

B. H. B.

**BANNATYNE, ARCHIBALD** (1853-1931), American inventor, was born at Glasgow, Scotland, in 1853. He went to the United States in 1878 and worked first as a blacksmith and later as a mechanic for the Waterbury Clock Company. Later he became foreman and master mechanic and set himself to the problem of devising a cheap watch of standard machine-made parts. He succeeded in his attempt but his invention was the property of the Waterbury Clock Company and was shortly afterwards sold to Ingersoll Brothers who gave it their name and sold it widely. Bannatyne founded his own clock company at Brooklyn, N.Y., in 1906 but attained no success and sold it 6 years later. Then he maintained a connection with the Ansonia Clock Company until his retirement in 1922. He died at Naugatuck, Conn., Jan. 29, 1931.

**BANNOCK**, a Shoshonean tribe whose language is closely allied to that of the Ute. Physically they bear a closer resemblance to the NEZ PÉRCÉ than they do to other Shoshonean-speaking peoples. In pre-Reservation times these nomads ranged in southeastern Idaho and western Wyoming. As early as 1869, together with a large number of Shoshoni, they were gathered at Fort Hall Reservation in Wyoming. Like the Ute they are classified with the tribes of the Plateau Area, but their culture was considerably modified by contact with Plains peoples. Their social organization was simple; they lived originally in grass-covered conical houses, and were in large measure dependent on the buffalo herds for food and the raw material of their clothing and utensils.

**BANNOCKBURN, BATTLE OF**, June 24, 1314, a battle fought by the Scottish forces, led by Robert Bruce, and the English army, under Edward II, at the village of Bannockburn, near Stirling, on the Scottish border. Bruce with an army of 30,000 was besieging Stirling Castle, and Edward with 100,000 men had come to its relief. After much slaughter the English fled, pursued by the Scotch, and are said to have lost about 30,000 men, while 4,000 were lost by the victors.

**BANQUO**, in Shakespeare's *Macbeth*, a friend and fellow general of Macbeth. When Macbeth is told by the witches that Banquo's descendants will inherit the crown, Macbeth has Banquo murdered, but fails to have his son Fleance killed. He is afterwards haunted by Banquo's ghost.

**BANTIN** or **BANTING** (*Bibos sondaicus*), the wild ox of Borneo, Java and eastern Burma. It closely resembles the common ox. The adult bulls are completely black except for a white patch on the rump and white on the legs, but the cows and young are reddish brown. The tail comes below the hocks and the horns vary in different districts. Bantin are wild in Burma, but domesticated in Bali and Java, and many are sent to Singapore as beef cattle. In Burma the bantin are represented by the tsine which live on the grassy plains instead of in the jungle. Tsine bulls are rufous fawn instead of black.

**BANTING, FREDERICK GRANT** (1891- ), Canadian physician and scientist, was born at Alliston, Ontario, in 1891. He was educated at the University of Toronto, served in the World War and returned in 1919 to practice medicine in London, Ontario. In 1921 he began researches at the University of Toronto on the secretions of the pancreas, which led a year later to his discovery of insulin, a specific remedy for diabetes. The Nobel prize, which was awarded to him in 1923, he shared with Professor Macleod of the University of Toronto and with his associates Drs. Collip and Best. He was appointed professor of medicine at the University of Toronto in 1923, and, as a recognition of his discovery, the Canadian Parliament voted him an annuity of 1,500 pounds. In 1923-24 a Banting Research Foundation was established to carry on his work. M. F.

**BANTRY BAY**, an inlet on the southwestern coast of the Irish Free State, in the county of Cork. It is from 3 to 5 mi. wide and extends 25 mi. inland, terminating in Glengarriff harbor. The village by this name is famous for its scenic attractions. Within the bay are Whiddy and Bear islands. Bearhaven is used as a naval port of call.

**BANTU**, negroid peoples inhabiting much of central and southern Africa. They are grouped on purely linguistic criteria, the Bantu language having certain unmistakable peculiarities. The language is generally considered to have had its origin in the Great Lakes region, and the dialectic differences among the various peoples speaking it are of such a character that a great antiquity for the dispersal to present territories cannot be assumed. Geographically, on a cultural and somewhat historical basis, the Bantu may be divided as follows: Eastern Bantu, Southern Bantu and Western Bantu. The southern and western divisions are the largest both numerically and territorially. In the Union of South Africa alone Southern Bantu in 1926 numbered upwards of 5,000,000.

The Bantu show a great diversity of types depending upon the degree of mixture with Hamitic, Negrito and other elements. In color they range from



the black of the Amaswazi to the yellowish brown of some of the Bechuana, a dark chocolate with a reddish ground tint being the prevalent hue. Their hair is of the ordinary short woolly Negro variety, their heads generally dolichocephalic with big black eyes, low broad noses and thick fleshy lips. Hair on the face is sparse, and a beard does not develop until the middle twenties. Almost without exception Bantus are agriculturists. All practice iron smelting, and certain tribes are noted for their skill in wood carving, pottery making and basket weaving. The principal subdivisions of Bantu, which are in turn subdivided into tribes, are: Bakalai, Bakuba, Baluba, Balunda, Basuto, Bechuanas, Congo, Dualla, Fans, Herero, Lunda, Mpongwe, Nyoro, Rua, Sechuana, Swahili and Zulu.

**BANTU**, a group of more than 100 languages spoken throughout Africa, except in the Hottentot and Bushman areas, south of a line running roughly from Duala in the Cameroons through Uganda to the southern frontier of Somaliland. The differences between the various subgroups are not very great, and are generally due to phonetic change. The words are mostly dissyllabic, and all end in a vowel, while the distinction between singular and plural is indicated by prefixes which vary according to the nature of the noun, as *muntu* "man," *bantu* "men," whence the name given to the entire group. The Bantu languages have been reduced to writing by Europeans, and grammars of more than 100 have been published. Investigation of their connection with Ancient Egyptian is in progress, tending to modify many opinions currently held; and their affinity with the SUDANO-GUINEAN group seems certain, though not generally admitted until recently. The Swahili and the Sotho (Basuto) have composed original poems, novels, etc.

L. H.

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**BANVILLE, THÉODORE FAULLAIN DE** (1823-91), French poet, dramatist, and novelist, was born at Moulins, Mar. 14, 1823. He was a prolific writer of verse and prose and is regarded as representative of the romantic school of French poetry. His best verse is found in *Cariatides*, 1842, *Stalactites*, 1846, and *Odes funambulesques*, 1857. *Mes Souvenirs* is a good example of his prose, and *Gringoire* is perhaps his outstanding drama. Banville died at Paris, Mar. 13, 1891.

**BANYAN** (*Ficus benghalensis*), a remarkable evergreen species of FIG noted for its peculiar mode of growth. It is a native of tropical Africa and also of India where it is a sacred tree. It grows from 70 to 100 ft. high, sending down from its larger branches aerial roots which establish themselves in the ground and develop into prop trunks. From these prop trunks similar aerial shoots descend and likewise take root. With increasing age the tree becomes a small grove of connected stems occasionally

covering a large area. Immense banyans with several hundred prop trunks and several thousand smaller trunks are known. The botanical gardens of Calcutta contain a famous banyan more than 100 years old with more than 200 separate trunks measuring upwards of 6 ft. in diameter. It is estimated that several thousand people can readily find shelter under some of the larger trees. By the peoples of India healing powers are ascribed to the bark and leaves; the soft, porous wood is of little value. See also *FICUS*.

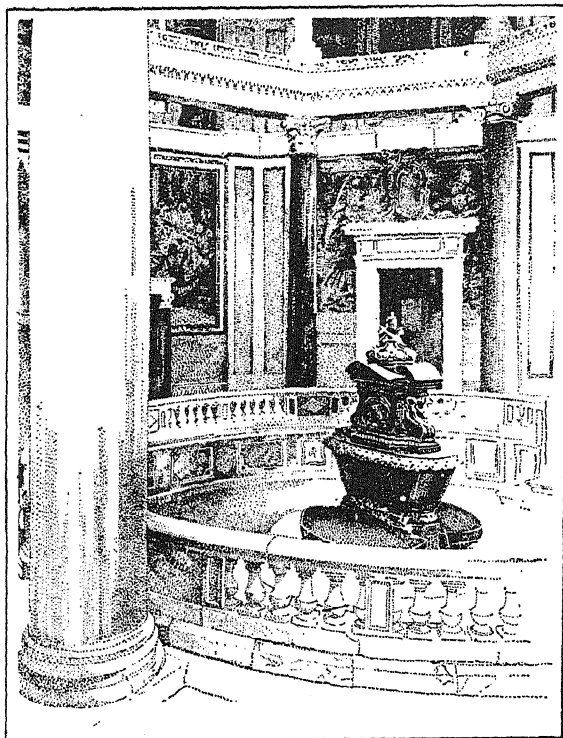
**BAOBAB** (*Adansonia digitata*), called also cream-of-tartar tree and sour-gourd, a massive tree of the bombax family, native to tropical Africa and grown in other warm regions. In girth it is one of the largest known trees, frequently reaching a diameter of 30 ft., though rarely rising above 70 ft. in height. Branches as thick as tree trunks and 60 to 70 ft. long, bearing leaves like those of the horse-chestnut and huge white flowers, form a dense massive head. The large gourd-like fruit, eaten by monkeys and hence called monkey bread, is prized for its pleasantly acid pulp. The leaves and fruit possess medicinal properties, and the bark furnishes strong fiber for making rope and cloth.

**BAPHOMET**, an idolatrous symbol which the **TEMPLARS** were accused of worshiping.

**BAPTISM**, a religious ceremony signifying various forms of purification and initiation, is common to several ancient and modern religious systems, including Mithraism, the Roman religion, Hebrew religion and Christianity. It has taken the forms of immersion, washing and sprinkling, the first and last of which applications exist in various Christian churches to-day. With the Jews the bathing of the whole body in clear cold water, if possible in a running stream, was a recognized means of restoration from a state of ceremonial uncleanness. According to rabbinical teachings, even before the existence of the temple, baptism, next to circumcision and sacrifice, was an absolutely necessary condition to be fulfilled by each proselyte to the Jewish faith. In the Christian churches it is believed to signify such benefits as regeneration, new birth, salvation, the gift of the Holy Ghost, and denotes admission to the membership of the church. In some churches it is considered a sacrament which remits all penalty due for sin, "original and actual," and imprints an indelible character mark on the soul. Baptism by immersion is considered valid by practically all Christian churches; the Baptist Churches believe it to be the only valid form.

**BAPTISTERY**, a building or part of a building devoted to the rite of baptism. Early Christian baptism being by immersion, it was natural that Roman bathrooms should be used. The earliest existing baptistery, that of St. John Lateran, was built by Constantine on the model of such a room or even, as some suppose, merely altered from one of the Lateran Palace bath chambers. It is octagonal, surrounded by an aisle or ambulatory; originally the basin was in the center. The tomb of Constantine's daughter, now

the Church of Santa Costanza, was also used at one time as a baptistery. The building of round or polygonal baptisteries spread widely at an early date; there were two in Ravenna, the Baptistery of Neon,



THE BAPTISTERY OF ST. JOHN LATERAN, ROME  
*Interior view, showing the font and a portion of the ambulatory*

called San Giovanni in Fonte, 449-58, and Baptistery of the Arians, called Santa Maria in Cosmedin, of the same period. The church of St. Jean in Poitiers, 676-96, was also originally a baptistery.

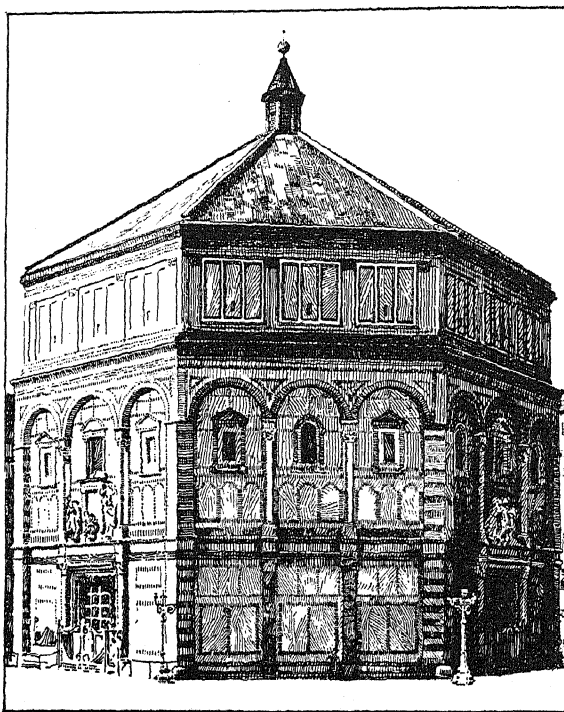
The change to baptism by sprinkling, in the 9th and 10th centuries, was generally followed by making the baptistery only a subordinate room or chapel, opening from the church proper, if possible near the church entrance. Yet the habit of building large polygonal or round baptisteries continued in force in north Italy until the 12th century, producing such magnificent examples as those of Pisa, 12th and 13th centuries, and Florence, 11th-12th centuries.

In the modern Baptist churches, where baptism by immersion is still in force, a small tank is frequently contrived in a recess at the back of the chancel, so that the baptisms can be seen by the entire congregation. *See FONT.*

**BAPTISTS**, a body of Christians whose fundamental emphases have been biblical literalism, religious liberty as the inherent right of the human personality, complete separation of Church and State, the autonomy of the local church and fellowship with other churches, the conception of a church consisting of those who have personally experienced salvation and publicly professed faith in Christ, rejection of

infant baptism, insistence that the original mode of baptism was immersion, and simplicity in worship. They have adopted numerous confessions of faith, but the basis of their principal doctrinal formulations is the Westminster Confession of Faith. Modern Baptists are not to be identified with the continental ANABAPTISTS of the early 16th century whose lineal descendants are the MENNONITES. They originated early in the 17th century among English Separatists seeking asylum in Holland.

**Origin of Denomination.** It was in 1609 at Amsterdam that John Smyth, after rejecting infant baptism and accepting the Arminian theology, re-baptized himself and others by affusion. A number of his adherents returned to Spitalfields near London and established the first English Baptist Church in England. The English Particular Baptists were Calvinistic in theology, insisting that Christ had died for the elect only. They developed out of a London Separatist Church, from 1616 on. This branch intro-



EXTERIOR OF THE BAPTISTERY AT FLORENCE (11TH CENTURY)  
*Its celebrated bronze doors were designed by Lorenzo Ghiberti*

duced immersion in 1641. As late as 1653, the Arminian or General English Baptists still used affusion as the mode of baptism. Prior to 1660 no General Baptist confession of faith referred to immersion. The point in dispute was the subject of baptism, not the amount of water employed in the rite. Hence, at the present time numerous Baptist churches in Great Britain and in the United States decline to make immersion prerequisite to membership.

In the time of Cromwell, English Baptists suffered from a millennialist epidemic and popularized the

congregational singing of English hymns. For three decades after the Restoration, they were restricted in worship and sometimes severely persecuted. After 1689, in consequence of Socinianism and hyper-Calvinism, they disintegrated. Rejuvenation came in 1770 through the New Connexion formed from remnants of the General Baptists and numbers influenced by the Methodist revival. In 1783 William Fox began to teach the Bible to children. In 1792 as a result of agitation by William Carey, the English Calvinistic Baptists on a capital of £13 2s. 6d. undertook foreign missionary work. Soon portions of the Bible were printed in some 40 different dialects of India. In the course of the 19th century, responding to the needs of the modern environment, English Baptists consolidated their work, the present Baptist Union being organized in 1891. Baptist work in Wales dates from 1649; in Scotland from 1750. In 1930 there were 3,178 Baptist Churches in Great Britain and Ireland with a constituency of 406,342 members and 2,051 pastors and missionaries; a total of 11,297 baptisms being reported.

**The United States.** Nearly four-fifths of the Baptists in the world live in the United States. In 1930 they claimed 53,888 churches, 49,907 pastors and missionaries, 8,681,327 members, and 5,370,045 Sunday School scholars, constituting more than seven per cent of the population of the country. They are divided into three major groups, Northern, Southern and Negro Baptists, and 15 minor groups. Three-fourths of the Northern Baptists live in the region east of the Mississippi. The most populous Northern Baptist states are New York, Pennsylvania, Illinois, Massachusetts, Ohio, Indiana, West Virginia, California, New Jersey and Michigan. The Southern Baptists are growing most rapidly, outnumbering Roman Catholics in North Carolina, South Carolina, Georgia, Tennessee, Arkansas, Alabama, Virginia, Mississippi, Oklahoma, Florida and Kentucky. The Negro Baptists are most numerous in Georgia, Alabama, Virginia, South Carolina, Texas, Mississippi, North Carolina, Tennessee, Arkansas and Louisiana. In 1916, 93.4 per cent dwelt in the South; in 1926, only 81.2 per cent. The migration has been mainly to northern states east of the Mississippi River. The 15 minor Baptist groups vary in number from the Bullockites with 36 members to the Landmarkers, or the American Baptist Association, with 117,858. But all 15 constitute only 5 per cent of the total Baptist population.

The Baptist denomination in America originated in 1639 in Rhode Island. Roger Williams was a member of the Providence church for only a few weeks, after which he withdrew permanently. About 1644 immersion began to be practiced. Early in the 18th century Philadelphia was the center of the American Baptist population. The charter of Brown University, 1764, the first Baptist college in America, declared that "into this liberal and Catholic institution shall never be admitted any religious tests." During the Revolutionary War, the Baptists universally sup-

ported the rebellion, numerous ministers serving as chaplains. That crisis was used to gain one of their fundamental principles, the separation of Church and State. In 1790 the Baptists controlled 868 churches with 64,975 members and 1,132 ministers. In 1817 the Baptist Education Society of New York was founded with a capital of \$13. From 1813 to about 1830, the followers of Thomas and Alexander Campbell and the Baptists were somewhat affiliated. But the Baptists refused to endorse the view that baptism synchronized with the remission of sins and the groups separated.

In 1845 the decision of the Foreign Mission Board not to appoint slaveholders as missionaries resulted in the withdrawal of the Southern Baptists and the organization of a separate convention. That separation continues. In 1907 the loose-jointed Northern Baptist missionary, educational and publishing societies with state conventions and standard missionary societies were amalgamated into the Northern Baptist Convention.

**Foreign Missions.** In 1814 the Baptist group in the United States was challenged to engage in foreign mission activity because Adoniram Judson on the way to India as Congregational missionary had adopted believer's baptism by immersion. To-day the American Baptist Foreign Mission Society has missions in India, including Burma and Assam, Japan, China, Africa, the Philippine Islands and numerous European countries. Exclusive of Europe, it employs 800 American missionaries and more than 10 times as many native helpers, ministers to over a quarter million members, and annually treats over one-half million patients. The Northern Baptists conduct nine theological seminaries, six training schools, a score of colleges and numerous academies. If the University of Chicago and the University of Rochester are included, the value of their educational property and endowment comes to over \$183,000,000. A liberal and exceedingly influential movement was the Baptist Congress, 1882 to 1913. The American Baptist Historical Society was formed in 1853. Educational activity is carried on through a Board of Education reorganized in 1920.

The Southern Baptists annually raise approximately \$8,000,000 for their benevolent, educational and missionary work at home and abroad. Their church property is valued at \$200,000,000. Some 40,000 students are cared for in three theological seminaries, two training schools, and numerous colleges and academies. Their missionary work covers 17 nations beginning with China, 1845, and Africa, 1846, Mexico and South America from 1879 on, and Europe from 1870 on. They employ over 500 American missionaries and five times as many native helpers for a constituency of 138,000 members. Over 20 hospitals and dispensaries care for the health of the natives.

Distinctive Negro Baptist churches have existed from before the Revolutionary War to the present, beginning with the church established by eight slaves at Silver Bluff, Aiken County, S.C., prior to 1778. The first African Baptist Church of Savannah, Ga.,

was constituted in 1788. In 1836 the first Negro Baptist Association in United States was formed in Ohio. The consolidation of various Negro organizations occurred in 1895 when the National Baptist Convention was organized. Its work is divided among seven boards. Its publishing house at Nashville does an annual business of about \$400,000. This convention is interested in over 100 schools. Its mission work is conducted in Africa, West Indies, South America, Russia and Japan. In 1883 its first missionaries journeyed to Africa. To-day over 50 missionaries and three times as many native helpers minister to over 3,000 converts. In 1890 the Negro Baptists in the United States owned 11,987 edifices with a value of \$9,038,549; in 1926, 20,011 edifices with a value of \$103,465,759. The annual expenditures now come to \$20,000,000. Ninety-six per cent of all Negro church members and 93 per cent of their church property are in the Baptist and Methodist denominations. The Baptists appealed to the American Negro because of immersion, the independence of the local church, and the opportunity for social prestige.

**British Dominions.** About the middle of the 18th century, Baptist principles were being proclaimed in Canada. In 1931 the Dominion of Canada contained 1,187 Baptist churches with 787 pastors and missionaries and 132,768 members. McMaster University in Ontario, Acadia University in Nova Scotia, and Brandon College in Manitoba furnish educational facilities. In 1834 the Baptist work in New South Wales was entered upon. Australasia now contains 35,982 Baptists ministered to by 436 pastors in 521 churches.

**Continental Europe.** In 23 countries of continental Europe, Baptist churches are found. The first church in France, composed of six members, was formed in 1835. Gerhardt Oncken and six others were immersed at Hamburg in 1834, by Barnas Sears of New York. America and Germany are responsible for the beginning of the Baptist church in Sweden. Gustaf Schroeder, a Swedish sailor, was converted at Mariner's Temple, New York City, in 1844. Another sailor, F. O. Nilsson, was baptized by Oncken at Hamburg in 1847. The two formed the Baptist church in Sweden. The Baptist constituency of Russia is estimated to be a million. There are Baptists in Poland, Hungary, Latvia, Denmark, Esthonia and Italy. In 1931 the world Baptist population was over 11,000,000, with 81 per cent in America, 15 per cent in Europe and Great Britain, and the remainder in Asia, Africa and Australasia. C. H. M.

**BAPTIST YOUNG PEOPLE'S UNION**, originally a religious organization founded at Chicago in 1891, federating numerous young people's societies connected with the Baptist churches of the United States and Canada. Since 1898 the title has applied to the organization of the southern young people only, whose headquarters is at Nashville, Tenn. The northern organization, which has headquarters in Chicago, is called the Baptist Young Peoples' Union of America and includes young people of the Canadian

Baptist churches as well as those of the churches belonging to the Northern Baptist Convention. Both organizations work to promote Christian activities, denominational loyalty, religious interest and missionary interest.

**BAR**, an embankment of sand, silt, or gravel deposited by a stream within its channel, or across its mouth, or by shore currents athwart a bay or harbor. Such shoals, usually submerged and sometimes shifting, often obstruct navigation. Sand-bars in a stream may grow into enduring islands, or wave-action may build a harbor-bar like that linking Nahant, Massachusetts, to the mainland, into a peninsula.

**BAR, THE**, a railing enclosing the part of a court hearing room to which the judges, officers (including members of the bar) and attendants of the court, litigants and witnesses are admitted. Only persons selected on bases of legal learning, character and experience are permitted to come within it to present to the Court the contentions of their respective clients. Hence these are said to be admitted to or into the Bar, and such persons as a class are known as "the Bar," or "barristers." The term as used to-day may embrace all licensed to practice law in a given country or geographical locality or court, as when used in the expressions "the American Bar" and "the United States Supreme Court Bar." Some would feel that this expression excludes those licensed to practice but not active in the legal profession, as, e.g., those who have retired or entered other employment. When contrasted with "the Bench," the term clearly excludes those holding judicial positions, though otherwise it may include them. C. M. U.

**BARABOO**, a city in south central Wisconsin, the county seat of Sauk Co., situated on the Baraboo River, 43 mi. northwest of Madison. The Chicago and North Western Railroad serves the city. The vicinity is good farming country. Baraboo has woolen mills. Near by is Devil's Lake, a famous quartzite formation, set aside as a State park and game preserve. Baraboo, an attractive summer resort, was founded in 1859 and incorporated in 1882. Pop. 1920, 5,538; 1930, 5,545.

**BÁRÁNY, ROBERT** (1876- ), Austrian physician and otologist, was born in Vienna, April 22, 1876. He was lecturer on diseases of the ear at Vienna from 1909 until the outbreak of the World War. He was taken prisoner by the Russians at Przemyśl in 1915 while serving as military physician. In 1917 he became assistant professor in diseases of the ear, nose and throat at Upsala University. He received, in 1914, the Nobel prize in medicine for his investigations in the physiology of deafness and of equilibrium. He has written a book and innumerable monographs on the subjects of his research.

**BAR ASSOCIATION, AMERICAN.** See AMERICAN BAR ASSOCIATION.

**BARBADOS**, an island of the British West Indies, one of the group known as the Lesser Antilles. It is 21 mi. long and has an area of 166 sq. mi. Coral reefs encircle the island which is accordingly dan-

gerous of approach. The surface is diversified, broken up by hills and valleys. Nearly one-half the area is under cultivation and the soil is very productive. Sugar, cotton, molasses and rum are the principal exports. The imports include textiles, flour, rice, coal and iron and steel manufactures. Trade is chiefly with Great Britain and the United States. The island is under the control of a governor working in conjunction with two councils and a representative assembly of 24 members, annually elected. Bridgetown, with an estimated population of 13,486, in 1929, is the capital and largest settlement. Barbados was colonized by the English in 1625 and has since been uninterruptedly a British possession. Est. pop. 1931, 173,674.

**BARBARA, ST.**, a virgin martyr of legendary fame. The scene of her martyrdom was set by various traditions either at Nicomedia or Heliopolis, Egypt. She is said to have been the daughter of a rich heathen, Dioscorus, who shut her up in a tower where he built a bathhouse to which Barbara added three windows in honor of the Trinity. She rejected a suitor proposed by her father, and declared herself a Christian. Dragged before the prefect, Martinianus, she was tortured and beheaded, her father acting as executioner. On his way home the unnatural parent was struck by lightning and consumed.

**BARBARA FRIETCHIE**, the heroine of a poem by J. G. Whittier, founded on a report of an act of patriotism by an aged woman of Frederick, Md., in unfurling the Union flag in the presence of Confederate troops and of the chivalry of Gen. Stonewall Jackson.

**BARBAROSSA.** See **FREDERICK I.**

**BARBARY APE** (*Macaca sylvanus*), a monkey inhabiting Morocco, Algeria, and the Rock of Gibraltar; the only monkey found wild in Europe. It is about the size of a large dog, the tail being invisible externally. In color it is light yellowish brown above and yellowish white below, with the naked part of the face flesh-colored. The Barbary ape lives on the ground and goes about in droves. When young, this monkey makes a lively, intelligent pet, but when older it is sullen and ill-tempered. This animal was probably the *pithekos* of the Greeks and used by them for the study of anatomy.

**BARBARY WARS**, 1801-05, War with Tripoli; 1815-16, War with Algiers), conflicts of the United States with the Barbary powers, caused by piratical interference with American vessels. The policy of Great Britain had been the payment of tribute to the Barbary powers for the protection of its vessels in the Mediterranean. When the United States became an independent nation, its commerce lost this protection, and in 1785 an Algerine corsair captured two American ships. In 1793, in an epidemic of piracy, 11 American merchantmen were seized in the Mediterranean, and their seamen and passengers enslaved. The United States simultaneously began the development of its navy and, as a temporary measure, the payment of tribute to the rulers of Algeria, Trip-

oli, Tunis and Morocco. The pasha of Tripoli, dissatisfied with his portion of the tribute, on May 14, 1801, cut down the flag at the American consulate in Tripoli. On May 20, before the report of the outrage at Tripoli had reached him, President Jefferson despatched a squadron of four vessels under Commodore Dale to the Mediterranean, to make a demonstration of strength. The schooner *Enterprise*, on detached duty, captured and dismantled a Tripolitan cruiser, while the frigate *President* visited the ports of Algiers and Tripoli. In 1803, with Commodore Preble in command of the squadron, the war was prosecuted vigorously. The Emperor of Morocco was overawed into promising immunity to American ships. The American vessel *Philadelphia*, however, running aground off Tripoli, was surrendered by Capt. Bainbridge to a fleet of Tripolitan gunboats; and Bainbridge and his crew were kept prisoners until the close of the war.

The *Philadelphia*, confiscated by Tripoli, was floated, and anchored in the harbor of the capital. It was fired by a courageous expedition under Lieut. STEPHEN DECATUR, which successfully braved the forts and gunboats commanding the harbor. In 1803-04 Commander Preble's fleet was augmented by three newly built vessels, which joined in several bombardments of Tripoli. The Tripolitan position was weakened by domestic insurrection fomented by William Eaton, an American adventurer. In 1805 Tobias Lear, American Consul General at Algiers, and Commodore Rodgers, lately given command of the fleet before Tripoli, negotiated a treaty wherein the Pasha of Tripoli agreed to keep peace with the United States without tribute, and, for \$60,000, to release the officers and men of the *Philadelphia*.

The Barbary powers took advantage of the War of 1812 to renew depredations upon American commerce. Commodore Decatur in May 1815 sailed from New York with a fleet of 10 vessels. Two Algerine cruisers were captured, and the war brought to a quick close by a treaty with Algiers abolishing any demand upon the United States for tribute and releasing all imprisoned American seamen. The appearance of his fleet was sufficiently formidable to induce the rulers of Tunis and Tripoli to make similar agreements.

**BARBER OF SEVILLE, THE**, a comic opera in two acts by GIOCHINO ROSSINI, libretto based on Beaumarchais's comedy of the same name by Cesare Sterbini; première, Rome, 1816, London, 1818, Paris and New York, 1819. Of a score of opera by Rossini it ranks next in popular favor to *William Tell*.

The setting of the opera is Spain. Madly in love with the charming Rosina, Count Almaviva finds himself thwarted by her guardian, Doctor Bartolo, who plans to marry her himself and win her dowry. As the doctor keeps his ward under lock and key, the count is at a disadvantage. However, Figaro, known as the Barber of Seville and as a romantic wag, comes to Almaviva's assistance, first by smuggling him into Bartolo's house as a soldier, and then, when this

scheme fails, as a music teacher. Furthermore, in order to allay Bartolo's suspicions, the prankish Figaro instructs Almaviva to pretend that he is in love with another woman. Bartolo is therefore shown a letter which Almaviva's mistress is said to have written him, although the letter is actually from Rosina. The doctor, delighted with the news of the count's infidelity, hastens to tell his ward of the circumstances, and she in turn becomes jealous, agreeing now to marry her guardian. A notary is immediately summoned. However, Figaro bribes the notary to substitute Almaviva's name on the marriage contract, the latter persuades Rosina of his fidelity, Bartolo is duped into signing his approval of the marriage, and all ends happily when Almaviva, in compensation for the trick played on Bartolo, offers him the coveted dowry of the fair Rosina.

**BARBERRY**, a genus (*Berberis*) of low shrubs of the barberry family. Numerous species are grown for their attractive flowers and fruit and for their foliage which displays brilliant autumn coloration. There are about 175 species widely distributed in north temperate regions and also along the Andes in South America. They are spiny shrubs with yellow wood and inner bark, small leaves, bright yellow flowers in drooping clusters and an oblong, usually red, berry-like fruit. The common barberry (*B. vulgaris*), native to the Old World and widely naturalized in eastern North America, is a smooth shrub, sometimes 8 ft. high. It was formerly extensively planted for ornament, but since the discovery that it acts as a host plant for the destructive wheat rust fungus its cultivation has been largely discontinued. The similar Japanese barberry (*B. Thunbergii*), which does not harbor the wheat rust, is now widely planted. See also MAHONIA.

**BARBER'S ITCH**, scientifically known as tinea sycois, is an infection of the hair follicles of the beard caused by the parasite *Trichophyton tonsurans*. The condition has received its name from the fact that it may be acquired in a barber shop from improperly sterilized equipment.

In this disorder small blisters form about the roots of the hairs, which become inflamed and filled with pus or infected matter. The hair over them is stubby and brittle, and, notwithstanding the name, there is no itching. The condition spreads rapidly and often becomes chronic. Removal of the hair and the use of antiseptic ointments is the usual form of treatment, while X-ray applications give very good results.

**BARBERTON**, a city of Summit Co., O., on the Tuscarawas River, which was at one time the western boundary of the United States. Barberton is 6.5 mi. south of Akron. Served by several trunk line railroads, the city is a fast growing industrial center. It manufactures boilers, sewer pipe, valves, insulators, tires, matches, soda ash used in making plate glass, and other products. In 1929 the value of the factory output was about \$43,000,000; the retail trade amounted to \$11,057,359. The surrounding country is occupied with dairying, poultry-raising, and potato-

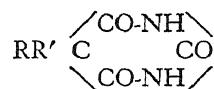
growing. An abundance of natural gas is found and there is a salt stratum underlying Barberton which the founders, about 1890, purposed to develop. Their intention, however, was deflected by industrial interests, but within later years the salt deposits have been developed. Lake Anna Park, adjacent to the business section, and Portage Lakes, southeast of Barberton, afford recreational facilities. Pop. 1920, 18,811; 1930, 23,934.

**BARBETTES**, on warships, large nonrotating armored, cylindrical structures below turrets, extending down to the armored decks and protecting the turret ammunition supply. Often the turret roller path is carried on a separate inner structure to prevent its injury if impacts distort barbette armor.

**BARBITAL**, or **VERONAL**, name for diethylbarbituric acid, diethylmalonylurea,  $\text{CO}(\text{HN}.\text{CO})_2$ ,  $\text{C}(\text{C}_2\text{H}_5)_2$ , officially known in Great Britain as Barbitone, introduced under the proprietary name Veronal. It is a white crystalline powder, odorless, having a bitter taste. Barbitol and its derivatives have the properties of inducing sleep, apparently without other effect. Many cases of poisoning, some fatal, have occurred from its indiscriminate use (overdose). It is frequently given in the form of the sodium salt known as soluble barbitol (barbitol sodium). See also BARBITURIC ACID AND ITS DERIVATIVES.

**BARBITONE**. See BARBITAL.

**BARBITURIC ACID AND ITS DERIVATIVES** are the most important hypnotics, or sleep-producers, and sedatives available. Over 100 barbituric acid derivatives of the formula



are known. Certain other members of the series are more effective than BARBITAL (Veronal) as sleep producers, and are employed for specific medical purposes. Phenobarbital, or Luminal, is important in controlling epileptic seizures. Certain others, such as Nembutal, Amytal, and Pernocton, are valuable in relieving apprehension and tension before operations, and producing a state of amnesia during and following operations. Apparently, all of the active barbituric acids are of value in increasing the individual's tolerance to local anesthetics. Some barbituric acids induce sleep of longer duration; others produce a relatively short effect which is desirable in operative procedures. In therapeutic doses, the barbituric acids are of low toxicity and are relatively free from undesirable side effects. Certain ones, such as barbitol and phenobarbital, are largely excreted unchanged in the urine, while others are almost entirely decomposed in the body and are more prompt and less prolonged in action. The most important barbituric acid derivatives used in the United States are: Barbitol, Ipral, Allonal, Neonol, Amytal, Nembutal, Phenobarbital, Dial, Phanodorn, and Pernocton.

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